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### OVARIAN FIBROMAS AND THECA-CELL TUMORS: REPORT OF 78 CASES WITH SPECIAL REFERENCE TO PRODUCTION OF ASCITES AND HYDROTHORAX (MEIGS' SYNDROME)\*†

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THE association of ascites with hydrothorax was observed as far back as 1879, when Cullingworth reported a case.<sup>1</sup> Its clinical importance and practical implications, however, were not appreciated until Meigs and Cass<sup>2</sup> called special attention to the syndrome since become known as the Meigs' Syndrome. In 1885, Terrier,<sup>3</sup> stressed that ascites does not indicate malignancy in every case. Since the publication by Meigs et al., the occasional occurrence of ascites has been noted in connection with other benign ovarian tumors such as myomas, fibroadenomas, benign seropapillary cystomas and struma ovarii.

The object of the present report was first to analyze the cases of ovarian fibromas and theca-cell tumors encountered in the gynecologic material of Mount Sinai Hospital with special reference to the incidence of ascites and hydrothorax, and secondly to determine, if possible, how these effusions are produced.

The comparatively frequent association of ascites with ovarian fibromas has been recognized by gynecologists for a long time. Statements concerning the frequency of its occurrence, however, differ considerably. Kermauner,<sup>4</sup> for example, had only one case of extensive ascites in his large material, whereas other authors found its occurrence in 40 to 50 per cent of their cases. This great difference may be explained by the statistical error of small numbers on the one hand, and by the selection of the material on the other. Authors who have pub-

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lished a high percentage of ascites in their own series, for example Lippert<sup>5</sup>—72 per cent, Stuebe<sup>6</sup>—50 per cent, Peterson<sup>7</sup>—40 per cent, most probably did not include the cases of small fibromas.

*Incidence.*—In the period between 1928 and 1943 (inclusive), 78 cases of fibromas and theca-cell tumors were encountered in the Mount Sinai Hospital. Theca-cell tumors were included in our statistics because (1) they typify Meigs' syndrome as well as the fibromas; and (2) because in the period between 1928 and 1936, no distinction was made in the pathologic reports between these two kinds of tumors. Since 1936, every ovarian tumor of connective tissue variety was stained for fat, and the fat content has been regarded as an important characteristic of theca-cell tumors in differentiating them from fibromas.

The first group of tumors (from 1928 to 1936) consists of 23 cases. In 7 cases, the tumors were small, measuring at most 5 cm., in 10 cases, they were of medium size (from hen-egg to apple size); in 5 cases, they were large (bigger than an average-sized grapefruit). In one case, there was no definite note as to size. Ascites was observed in 9 cases of this group. In two the amount of fluid was small, in three moderate, and in four considerable. In six cases with ascites, the tumors were of large size, and in three they were of medium size. In seven cases, the tumors were edematous and, for the most part, cystic; in two cases they were hemorrhagic. Hydrothorax was met in only one case of this group. The pleural effusion was bilateral and much more pronounced on the right side than on the left. It was hemorrhagic whereas the ascitic effusion was described as amber colored. This unusual circumstance is not explained.

TABLE I

Size of tumor	Small	7	SIZE OF TUMOR
	Medium	10	
	Large	5	
Amount of fluid (9 cases of ascites)	Small	2	Large 1
	Moderate	3	Medium 1
	Considerable	4	Large 2 Medium 2
Condition of tumor in the 9 cases of ascites	Edematous and cystic	7	
	Hemorrhagic	2	

From this table it is seen that the amount of ascites does not depend altogether on the size of the fibroma.

The second group consists of 30 fibromas (including fibromyomas), 2 cases of papillary fibro-adenoma and 23 cases of theca-cell tumor. This fairly large group indicates incidentally that theca-cell tumors are not as rare as has been generally assumed. Three of the fibromas were large, 14 of medium size, and 13 small. There was a small amount of ascites in only 2 of the fibroma cases. The relative infrequent occurrence of ascites in this group is difficult to account for. In one of the two cases of papillary fibro-adenoma which we would prefer to include among the sero-epithelial rather than among the fibromatous growths, a small amount of ascitic fluid was found at operation. Hydrothorax was not found in any of these 30 cases of ovarian fibroma.

TABLE II

TYPE OF TUMOR	NUMBER	SIZE		
		SMALL	MEDIUM	LARGE
Fibroma	30	13	14	3
Papillary fibroadenoma	2	1	0	1
Theca cell	23	8	11	4
AMOUNT OF FLUID				
		SMALL	MODERATE	CONSIDERABLE
		0	4	3

Among the 23 cases of theca-cell tumors, ascites was noted seven times. The abdominal effusion was extensive in 3 cases with large tumors. A right-sided hydrothorax associated the ascites in one case. In 4 cases with a moderate amount of ascitic fluid, the tumors were only of medium size, i.e., from that of a hen's egg to the size of a grapefruit. In 6 cases with ascites, the newgrowths were edematous, in 4 cases cystic.

Thus, it is evident that theca-cell tumors are not infrequently accompanied by ascites (in 30 per cent of our material), and also that Meigs' syndrome may also be met in this class of tumors of the ovary. Since no distinction was formerly made between fibromas and theca-cell tumors, some of the "fibromas" with Meigs' syndrome mentioned in the literature may have actually been theca-cell tumors.

#### Clinical Significance of Ascites in Relation to Ovarian Tumors in General

Ascites, which is commonly found in the presence of ovarian tumors, as a rule, indicates the spread of malignancy to the peritoneum. In such cases, the origin of the ascitic fluid is easily understood. It is partially a wound secretion of the disintegrating tumor, and partially an exudate of the peritoneum which is irritated by the presence of the tumor. Frequently, the irritative condition is recognized by the intensive redness of the peritoneum, which may be present in areas not as yet involved in the malignant growth.

Pseudomyxoma and papilloma of the ovary produce peritoneal implantation, and though histologically not malignant, they assume an intermediate position between benign and malignant tumors, and produce in each case a similar type of ascites. Torsion of the pedicle, necrosis and inflammation may produce ascites in benign as well as malignant tumors. The amount of intraperitoneal effusion under these circumstances is usually scant. If we exclude these cases, then the presence of an ovarian tumor with a considerable effusion usually indicates malignancy and peritoneal spread. Dermoid cysts and pseudo-mucinous cysts are only exceptionally accompanied by ascites, a fact recognized by gynecologists for a long time; and the more recently described Brenner tumors are never associated with ascites.

In reviewing John Miller's<sup>8</sup> large collection, from various sources, of 2,748 ovarian tumors, we noted that ascites was present in 6 per cent of the benign and in 45.8 per cent of the malignant ovarian tumors.

However, these figures should be viewed with caution, since on the one hand, notes on small amounts of peritoneal effusion are frequently omitted in the clinical records and, on the other hand, cases of twisted ovarian tumors and inflammation might have been included.

*Origin of Ascites.*—The problem of the origin of the ascitic fluid is still unsolved. Attempts to explain its origin on a mechanical basis or chemical irritation of the peritoneum (Olshausen,<sup>9</sup> Pfannenstiel,<sup>10</sup> Shober,<sup>11</sup> et al.) have not been satisfactory. No convincing evidence of such irritation was adduced. Neither the composition of the ascitic fluid, nor the anatomicopathological condition of the peritoneum as observed in the limited number of cases where special attention was paid to these two factors, confirmed the assumption of a peritoneal irritant. The idea that there may be a causal relation between the abdominal effusion and Selye's<sup>12</sup> "alarm reaction" is, in our opinion, not justified. This is in accord with the opinion held by Meigs. The "alarm reaction" is a response of the organism to an irritant to whose qualitative and quantitative effects the organism is not accustomed. That ovarian fibroma does not produce ascites by its mere presence within the peritoneal cavity is borne out by the fact that uterine fibroids, despite their size, similarity in structure and degenerative changes cause ascites only in very rare cases. Kelly and Cullen<sup>13</sup> reported seven such cases, one of them with pleural effusion as well, and a similar case was published from Dr. R. T. Frank's Service at Mount Sinai Hospital.<sup>14</sup>

A more acceptable theory is that which has been offered by Spence and Miller, namely, that the ascitic fluid may originate from the tumor itself. Miller<sup>8</sup> quotes as proof of his belief a very interesting observation of Geibel.<sup>15</sup> This author put the tumors of his two cases into a completely dry pot. After a few hours, the vessel was filled with clear, yellowish fluid. After 24 hours, one of the tumors, which measured 20 by 15 by 12 cm. and weighed 3,200 Gm. with the exuded fluid, weighed 2,050 Gm. without the fluid. Thus, it lost about one-third of its weight within 24 hours.

How can one explain the discharge of the fluid from the tumor? It is noteworthy that in all the reported cases of Meigs' syndrome in which the pathological histology of the tumors is described, special mention is made of edema, liquefaction and cyst formation. However, similar changes may be present in tumors which are unassociated with ascites. Unfortunately, however, no differentiation has been made in the reported cases between cyst formation (true liquefaction) and extreme edema or cystic dilatation of lymph spaces. Liquefaction and edema are different conditions. Liquefaction refers to dissolution of necrotic tissue. Edema on the other hand, is an accumulation of intercellular fluid which or may not be followed by nutritional disorders or necrosis of the edematous tissue.

In connection with the pathological degeneration of the ovarian fibroma as a possible cause of ascites, it is interesting to recall H. Spence's<sup>16</sup> discussion in 1906, of Amand Routh's<sup>17</sup> case of an ovarian

fibroma with ascites. Spencer stated that it was a difficult point to determine the cause of ascites in "ovarian fibroids." He had met with one case in which a bleb half an inch thick appeared on the surface of an "ovarian fibroid" and, by squeezing the periphery of the tumor with the hands, fluid could easily be made to ooze from a slight crack in the bleb. This led him to think that in at least some of the cases, the escape of fluid was due to pressure of the hard tumor on the lymphatics or blood vessels in the hilum of the ovary, which Poirrier and others had shown to be so large and numerous.

Considering the fact that the tumor is fibromatous, it is conceivable that constriction of the efferent lymph or blood vessels may take place in the tumor itself or in its pedicle, and thus produce congestion and lymph stasis which may be followed by exudation of tissue fluid on its surface.

Also, in connection with this subject, the question naturally arises as to why ovarian fibromas produce ascites so commonly, while uterine fibroids so rarely, even though both tumors have a similar parenchymatous histological structure and undergo similar circulatory and degenerative changes. The explanation may be found in the fact that uterine fibroids as a rule, are covered by a fibromuscular, dense capsule and invariably by a serosal layer, whereas ovarian fibromas do not have such a capsule, and like the normal ovary, no peritoneal cover. Instead of a true serosa, ovarian fibromas are covered by a low, single layered, very vulnerable and easily permeable surface epithelium which offers practically no resistance to the penetration of fluid from the ovarian tumor.

Bearing this in mind, it would be highly desirable in every case of ovarian fibroma, and particularly in cases with ascitic effusion, to note carefully the condition of the lymph and blood vessels of the tumor as well as the condition of the tumor surface. Injection of the vessels of the specimen might be helpful in revealing more detailed information.

*Origin of Hydrothorax.*—The origin of ascites in ovarian fibromas challenged inquiry as to its mechanism from the first observations that were made of this combined condition. But even more difficult and challenging was the explanation as to why the ascites was in some cases accompanied by a right-sided, and more rarely by a left-sided or bilateral pleural effusion. Reports of the combination of ascites and hydrothorax in benign tumors are found in the older literature. In 1909, Kelly and Cullen<sup>13</sup> observed this syndrome in a case of uterine fibroids. In 1914, Caro<sup>18</sup> mentioned its occurrence in giant fibroma of the ovary.

But these observations remained unknown not only to the majority of the medical profession, but also to most gynecologists. Cases with this syndrome were regarded as inoperable and incurable and were, as a rule, treated with repeated paracenteses only. The greatest credit, therefore, is due Meigs for calling attention to the occurrence of ascites and hydrothorax in benign ovarian tumors, and in stressing its clinical

and practical importance. In 1943, Meigs, Armstrong and Hamilton<sup>19</sup> collected 27 such cases from their own material and from the medical literature of this country. In this collection, 18 had pleural effusion on the right side, 4 on the left, and 4 on both sides. In one case, there of this paper, Healy, Herrick and Watson, and Taylor added three other is no note about the location of the pleural effusion. In the discussion cases.

How can we explain the origin of the hydrothorax? And why does it occur on the right side in the great majority of cases? We made these questions the subject of an experimental and clinical study. The following considerations have appeared to us to be basic:

1. Within a few days, the pleural effusion completely and definitely disappears after the removal of the ovarian tumor, therefore, it is a direct result of the tumor and not of an independent or coexistent pleural disease.

2. As stated by Meigs in two cases, the pleural effusion has the same properties as the ascitic fluid. This justifies the conclusion that the pleural effusion originated in the abdomen and was transmitted to the pleural cavity.

3. In the few cases where the effusions were examined, they were poor in cells and had a low specific gravity—1.012 to 1.018, and only exceptionally higher. Thus, they have the characteristics of transudates and not of exudates.

4. The anatomic route by which fluid can be transferred from the abdomen into the pleura was identified a long time ago. As early as 1862 von Recklinghausen<sup>20</sup> described small openings between the endothelial cells of the diaphragmatic peritoneum which connect the subperitoneal lymph chain of the diaphragm with the subpleural lymph channels and called them stomata. Later on the correctness of von Recklinghausen's statements was, with some slight differences, affirmed by the majority of investigators. Anatomical studies reported by Kuettner,<sup>21</sup> Bartels,<sup>22</sup> Muscatello,<sup>23</sup> Sulzer,<sup>24</sup> Drinker and Yoffey,<sup>25</sup> and more recently by Allen,<sup>26</sup> Higgins and co-workers<sup>27</sup> show that both diaphragmatic surfaces except the tendinous center are rich in lymph vessels. Each half of the diaphragm forms a separate lymph sphere which has only scant connections with that of the other side. The right lymph network is by far better developed than the left. Both subperitoneal lymph networks communicate with the corresponding subpleural lymph networks through perforating vessels. The lymph is removed by five routes according to Higgins and Graham:<sup>27</sup> (1) The main route or the sternal route consists of 3 to 4 channels which course along the diaphragm between the intercostal muscles and run forward parallel to the thoracic artery and vein; (2) the pulmonary route consisting of vessels which carry lymph to the nodes at the hilum of the lungs; (3) vessels which run to the thoracic duct; (4 and 5) vessels that pass over the dorsal surface of the diaphragm, pierce it and empty their lymph into the renal and the pancreatic lymph nodes.

Experimental works of von Recklinghausen,<sup>20</sup> MacCallum,<sup>28</sup> Sulzer,<sup>24</sup> Lemon and Higgins<sup>29</sup> and others have shown that fluid and small corpuscular particles like India ink, carmine, and black lead pass through the diaphragm within a few minutes and that accumulations of these particles mark the location of the stomata. Clairmont and Haberer<sup>30</sup> demonstrated in 1905, that resorption from the peritoneal cavity of a solution of potassium iodide was much delayed after applying collodion over the diaphragmatic peritoneum. A similar delay of resorption of indigo carmine was shown in 1911 by Rubin,<sup>31</sup> after resecting the omentum in cats suggesting that this anatomic structure may play a role in transporting fluids toward the diaphragm.

In its transference from the subperitoneal to the subpleural lymph vessels the ascitic fluid follows the normal current directed toward the heart. But the intensity and velocity of this flow depends mainly on the respiratory action of the diaphragm which not only exerts a pump effect on fluid situated on the surface of the liver, but also considerably influences the width of the diaphragmatic stomata (Florey, Allen, et al.<sup>32</sup>). Paralysis of the diaphragm, according to Higgins, Beaver and Lemon,<sup>33</sup> considerably retards the transference of corpuscular elements but does not prevent it completely.

Considering all these facts, we are not surprised to find ascitic fluid in the pleura but wonder why it does not happen in every case of ascites. The following possibilities may account for it:

1. Rapid absorption of the fluid entering the pleura, thus preventing an accumulation of fluid in the pleural cavity.
2. Slow penetration of the fluid through the diaphragm so that it is absorbed by the pleura with the same speed as it takes to reach it.
3. Blockage of the diaphragmatic stomata by debris or obliteration of the stomata by chronic inflammatory changes of the peritoneum.
4. High osmotic pressure of the colloidal ascitic fluid counteracting the transudation of water. This possibility holds in pseudomyxoma where the myxomatous masses not only do not give up any water, but rather attract and adsorb some.

### Experimental Data

We tried to evaluate the action of each of these factors in the production of Meigs' syndrome experimentally on rabbits, rats and mice.

In the first group of experiments, saline stained with carmine or India ink was injected into the abdomen once or repeatedly, and the fluid content of the abdominal and pleural cavities was examined after various intervals.

In a second group, human serum stained with carmine was used instead of saline.

In a third series of experiments, an attempt was made to block the diaphragmatic stomata and the other peritoneal lymph drainage areas by injecting a suspension of kaolin 2 to 3 days before serum was injected.

## GROUP II

NAME AND NO.	AGE	STA- TUS	OVARIAN PATH.	DETAILS OF PATH.	OTHER PATH.	ASCITES	HYDRO- THORAX	CHIEF COMPLAINTS	SIZE
S. A. 340217	57	M	Fibroma l. ovary	Edematous with cystic degeneration	Cholilithiasis	Small amount of free, clear yellow fluid	None	Enlargement of abdomen	Large
L. B. 309645	38	M	Fibroma l. ovary	Hemorrhage and necrosis 20 by 25 by 14 cm.	-	Large quantity of bloody fluid	None	Feels unwell, chilly	Large
T. B. 238019	49	M	Fibroma	Edematous, grapefruit size areas of great cellularity and vascular	Uterine fibroids	Large quantity (about 1 gal.) clear fluid	None	-	Medium
M. C. 337216	52	M	Fibroma r. ovary 20 by 15 by 10	Edematous, partial necrosis	-	16 to 18 oz. amber colored	14,000 c.c. r. 500 c.c.	Irregular l. menses Enlargement of abdomen	Large
B. G. 387833	55	M	Fibroma l. ovary size of grapefruit	Cystic degeneration	-	None	None	Pain in abdomen	Medium
S. G. 373902	65	M	Fibroma l. ovary 3 to 4 em. diameter	Theca cell origin?	Huge multilocular serous cystadenoma	None	None	Pressure symptoms Albuminuria Edema of legs	Small
A. G. 825101	37	M	Bilateral ovarian fibroma: 1. 2 $\frac{1}{2}$ cm. diam., r. 2 by 1 by 1	-	-	None	None	-	Small
S. G. 350090	18	S	Fibroma l. ovary	Degeneration and cyst formation	Small r. ovarian cyst, "called", cystadenoma	About 1,000 c.c. of sanguineous fluid	None	Lower abdominal pain	Small
J. H. 367809	21	S	Fibroma r. ovary	6 by 4 em. (orange) cystic degeneration	-	Small amount with yellow tint	None	Metrorrhagia	Medium
J. H. 294517	39	Sep.	Fibroma of ovary side? r.?	Small	Chronic appendicitis	None	None	Periodic attacks of pain in R.L.Q.	Small
R. I. 312472	49	S	Fibroma r. ovary 24 by 14 by 10	Twisted, hemorrhagic	-	Moderate amount hemorrhage, twisted pedicle	None	Pain in r. side and back Vomiting	Large
M. J. 346886	34	M	Small (hazelnut) fibroma r. ovary	Very firm	r. hydrosalpinx Perioophoritis	None	None	Bleeding Headache Lower backaches	Small

R. L. 312773	59	M	Small calcified fibroma of a gyrateated ovary (nodule about size and shape of "os magnum")	Small calcified nodule	Acute appendicitis	None	None	Symptoms of appendiceal abscess	Small
H. M. 352791	40	M	Fibroma r. ovary 3½ by 3½ cm.	Completely encapsulated, very firm, very cellular	Uterine fibroids	None	None	Pain on r. side, dysmenorrhea, menorrhagia	Medium
J. M. 367157	35	M	Fibroma r. ovary 3½ by 1½ cm.	Very hard, nodular	Chronic appendicitis	None	None	Amenorrhea 7½ years	Small
B. O. 313135	53	M	Fibroma and adenocystoma r. ovary	Gangrene caused by torsion (melon-size)	Uterine fibroids	None	None	-	Medium
B. R. 379078	28	M	Fibroma l. ovary 13 by 9	Narrow pedicle, fib. encapsulated, gray-yellow on cross section Edematous, very cellular, small cysts	Uterine fibroids Pregnancy	Large amount of ascitic fluid in pelvis	None	Pain in lower pelvis	Medium
S. R. 397326	35	M	Fibroma r. ovary	-	Uterine fibroids	None	None	Gradual enlargement of abdomen	?
D. R. 319358	59	M	Fibromas r. ovary 6 cm. in diameter	Luteum cyst with thickened wall. Twisted?	-	None	None	Pain in lower r. side	Medium
S. R. 385795	30	S	Bilateral ovarian fibromas 1. 3.5 cm. diam. 2. 13 cm. diam.	1. Intensely hard, nodular, yellowish areas 2. Cystic	-	None	None	Pain in back	Medium
E. U. 293876	62	M	Fibroma of ovary 12 by 9 by 8	Smooth on section Fibrous, creamy white	Small cyst with clear fluid on surface	None	None	-	Medium
M. W. 317638	39	M	Fibroma r. ovary size of fist	Pregnancy	None	None	Pain R.I.Q. for 2 weeks	Medium	
B. W. 292964	45	M	Fibroma r. ovary size honey dew melon	Firm, hard, dense, white edematous tissue	Moderate amount	None	-	Large	

## GROUP II. FIBROMAS

NAME AND NO.	AGE	STA-TUS	OVARIAN PATH.	DETAILS OF PATH.	OTHER PATH.	ASCITES	HYDRO-THORAX	CHIEF COMPLAINTS	SIZE
A. A. 459713	16	S	Fibroma l. ovary	l. ovary—follicular cyst Nodule 3 mm. in diameter	Necrotic endometrial polyp	1 oz. clear amber-colored	None	—	Medium
S. A. 480993	22	S	Fibroma l. ovary	l. grapefruit	Small uterine fibroid	None	None	Pain in r. lower abdomen	Small
S. A. 457361	34	M	Fibroma l. ovary	Small papillomas l. ovary	Uterine fibroids	None	None	Pain lower abdomen	Medium
R. A. 500193	50	M	Fibroma	r. prune-sized	Uterine fibroid	None	None	Menorrhagia	Small
J. C. 492028	34	M	Fibroma r. ovary	Large ovary 1.23 by 1.5 by 1.5; small r. l. ovary cystic fibroma 7 by 6 by 4 cm.	Parovarian cyst	None	None	Profuse periods	Small
S. C. 432560	50	M	Fibroma r. and l. ovary	—	—	None	None	Menorrhagia back pain	Large
L. C. 18158	76	M	Fibroma l. ovary	Cystic Fibromyoma 7 by 4 by 2 cm.	Seroepithelial cysts	None	None	L.L.Q. pain	Medium
M. D. 416758	32	M	Fibroma r. ovary	Size of grapefruit; l. ovary small	Uterine fibroids	Small amount of amber-colored fluid	None	—	Medium
C. E. 354380	45	M	Fibroma	Small—pea-sized	Uterine fibroids	Small amount	None	Menorrhagia L.L.Q. pain	Medium
B. F. 438524	30	S	Fibroma	r. small cantaloupe, 1. plum	—	None	None	Constipation Nervous	Small
G. F. 353843	16 $\frac{1}{2}$	S	Fibroma	Small 2 by 2 by 1 cm.	Uterine fibroids	None	None	Amenorrhea Lower abdominal discomfort	Medium
S. F. 492628	44	M	Fibroma r. ovary	Small serous ovarian cyst	—	None	Pressure in pelvis	Small	

I. G. 443602	52	M	Fibroma	I. ovary fibroma small ( $2\frac{1}{2}$ cm. di- ameter)	Uterine fibroids	None	None	Severe menor- rhagia	Small
O. K. 446953	65	M	Fibroma r. ovary	30 cm. diameter	Follicular cysts 1. ovary	None	None	Loss of weight Increase in size of abdomen	Large
A. K. 449820	36	M	Fibroma	Plum-sized	Uterine fibroids, endometriosis	None	None	Menorrhagia Profuse flow Clots	Small
P. K. 501138	51	M	Fibroma r. and l.	R. 5 by 3. 5 by 3 L. 2 tumors, 10 by 6 by 7, 12 by 9 by 4 cm.	-	None	None	L.I.Q. pain Fullness and press- ing in abdomen	Medium
I. K. 444115	46	S	Fibroma r. ovary	Large 14 by 10 by 10 cm.	Uterine fibroids	None	None	Menorrhagia Lower abdominal pain	Medium
E. L. 441652	37	S	Fibroma	R. ovary (10 cm.) diameter	Follicular cysts	None	None	Pelvic mass	Medium
R. L. 480685	48	M	Fibroma r. and l.	Small	Uterine fibroids	None	None	Profuse periods bimonthly	Small
L. G. M. 355199	35	M	Fibroma	R. ovary	Dermoid cyst 1. ovary	None	None	Chronic appendi- citis	?
K. M. 456598	52	M	Fibroma r. ovary	Grapefruit	Uterine fibroids	None	None	Menorrhagia.	Medium
E. N. 483232	68	M	Fibroma r. ovary	Small fibroadenoma r. huge serous cyst and fibroad- enoma	Uterine fibroids	None	None	Lower abdominal pain	Small
I. P. 478844	43	M	Fibroma r. ovary	Small adenofibroma	Uterine fibroids	None	None	Menometrorrhagia R.I.Q. pain	Small
A. S. 422485	58	M	Fibroma l. ovary	L. 12 cm. R. Shrunken	Uterus atrophic	None	None	L.I.Q. pain	Medium
E. S. 503564	50	M	Fibroma side?	5 cm. diameter	Bilateral ovarian adenocarcinoma	None	None	L.I.Q. pain, pres- sure in rectum	Medium

GROUP II. FIBROMAS—CONT'D

NAME AND NO.	AGE	STA- TUS	OVARIAN PATH.	DETAILS OF PATH.	OTHER PATH.	ASCITES	HYDRO- THORAX	CHIEF COMPLAINTS	SIZE
Z. S. 492242	50	S	Fibroma l. ovary	Small	Uterine fibroids, endometriosis	None	None	Feels a tumor in stomach	Small
R. S. 369454	25	S	Fibroma l. ovary	Pedunculated 1.5 by 1.3 by 8 cm. with numerous small cysts	-	None	None	Pain in lower ab- domen	Large
F. S. 488742	47	S	Fibroma r. ovary	Small fibromyoma 2 by 1.5; l. ovary normal	Cyst r. ovary Uterine fibroids	None	None	Mass	Small
L. S. 486409	50	M	Fibroma r. ovary	Partially solid and cystic	Uterine fibroids, adenomyoma	None	None	L.L.Q. pain	Small
M. T. 462964	62	S	Fibroma l. ovary	Fibroadenoma 6 by 4 by 3 cm.	-	None	None	Pain, vomiting	Medium
L. W. 389961	62	M	Fibroma r. ovary	2 fibroids (a) 1.3 by 10 by 7 cm., (b) 2 cm.	1 small uterine fibroid	None	None	Acute abdominal glycosuria Abdominal disten- tion	Medium

## GROUP II. THECA-CELL TUMORS

NAME AND NO.	AGE	STA- TUS	OVARIAN PATH.	DETAILS OF PATH.	OTHER PATH.	ASCITES	HYDRO- THORAX	CHIEF COMPLAINTS	SIZE
I. B. 434351	58	M	Theca-cell tumor 7 by 5 by 3	With small cysts	-	None	None	Attack of "pyeli- tis,"	Medium
B. B. 413016	60	M	Theca-cell tumor 2.5 by 1.5	Pedunculated Encapsulated	Uterine fibroids Endometrial polyp, chronic appendi- ritis	None	None		Small
E. D. 420861	51	W	Theca-cell tumor l. ovary 12 by 9 by 6	Edematous	Adenocarcinoma r. ovary	Small amount of clear serous fluid	None	Lower abdominal pain Weight loss	Medium
M. F. 433424	52	S	Theca-cell tumor r. ovary 1.5 cm. diam.	-	Uterine fibroids Serous cyst l. ovary	None	None	L.L.Q. pain	Small
A. G. 468827	53	M	Theca-cell tumor l. ovary "large,"	Cystic degeneration	Uterine fibroids Edematous Chronic appendi- ritis	Serosanguineous fluid, small amount	None	Weight loss Weakness Slight jaundice	Medium
F. G. 429914	58	M	Theca-cell tumor l. ovary 17 by 15 by 10	17 by 15 by 10 cystic areas	-	No tumor cells Ascites abundant	Right	Dyspnea; leg swelling, en- largement of ab- domen	Large
L. H. 429702	51	S	Small theca cell tu- mors pea-sized	-	Uterine fibroids	None	None	Pains in chest	Small
B. K. 408858	58	M	R. ovary theca-cell tumor size of small melon	-	-	None	None	Pain in lower ab- domen and back	Medium
M. K. 408372	29	S	Theca-cell tumor 15 by 9 cm.	-	Chronic appendi- ritis	None	None		Medium
P. K. 484051	62	W	Theca-cell tumor r. ovary 15 by 12 by 8 cm.	Some cystic areas	-	None	None		Medium
Y. L. 482737	59	W	Theca-cell tumors l. ovary 10 by 8 by 4 cm.	Few hemorrhagic areas, in few places moderately softened	-	None	None	Backache	Medium

GROUP II. THECA-CELL TUMORS—CONT'D

S. L. 437240	57	M	Theca-cell tumors l. ovary 4 by 3 by 2.5 cm.	-	-	None	Intermittent spot- ting	Small
S. L. 421129	52	M	Theca-cell tumor	Cystic, large	-	Abdomen distend- ed indicating free fluid	None	Large
M. B. 421569	60	M	Theca-cell tumors r. ovary size large grapefruit	Several adematous blebs otherwise firm	Small fibroma l. ovary	None	Lower abdominal pain, nausea	Medium
M. N. 492201	39	M	Theca-cell tumor 10 em. diameter	Extremely hard numerous bundles with marked ede- ma, numerous yel- low areas	Uterine fibroids	None	Enlargement of abdomen, uri- nary frequency	Medium
C. R. 451096	74	W	Theca-cell tumor r. ovary 3 cm. di- ameter	Cystic, very edema- tous, cellular	Uterine fibroids	None	None	Small
M. R. 480462	73	M	Theca-cell tumor r. ovary 11 by 12 by 7	11 by 12 by 7 cm. cystic	L. ovary atrophic	Blood-tinted	None	Medium
J. S. 479150	60	M	Theca-cell tumor r. ovary apricot size	Uniform appearance	Uterine fibroids	None	Pain, frequency Retention	Medium
R. S. 427423	58	M	Theca-cell tumor r. ovary plum-sized. 5 by 4 by 2.5 cm.	Edematous	Uterine fibroids Hypertension	None	None	Small
M. S. 46258	62	M	Theca-cell tumor r. ovary 17 by 16 by 13	Areas with cystic degeneration	-	2 gals.	Irregular staining	Large
S. S. 475961	51	W	Theca-cell tumor l. ovary 8 by 6 by 4 cm.	-	-	3 oz. thin straw- colored fluid	Increase in size of abdomen	Medium
F. S. 444744	45	M	Theca-cell tumor r. ovary 3 by 2.75 by 2 cm.	-	Fibroid uterus	None	Pain in L.L.Q.	Medium
T. A. 469611	69	W	Theca-cell tumor l. ovary	-	Large multilocular serous cysts por- tion of which shows theca-cell tumor	None	Abdominal disten- tion	Small

In a fourth group, the swelling potential and water attracting power of gelatin was used to simulate the properties of certain abdominal effusions.

In a single but unsuccessful experiment we tried to watch the passage of a contrast medium (hippuran) through the diaphragm under x-ray control.

The results obtained thus far in these experiments were not entirely satisfactory. A moderate accumulation of fluid in the pleural cavity was observed in some of the experiments with saline and in some with serum. The injection of a kaolin suspension into the peritoneal cavity resulted in a locking effect. The inhibiting influence of gelatin on the absorption of intra-abdominal fluid and its transference into the pleural cavity was also demonstrable. Until recently, we had not succeeded in finding a reliable experimental technique which would artificially reproduce Meigs' syndrome with any degree of regularity. The last experiments made by injecting kaolin and India ink into the pleural cavity first, and carmine solution intraperitoneally four days later revealed carmine-stained fluid in both the pleural and peritoneal cavities three hours after the intraperitoneal injections, but none in either cavity after 16 hours. Large deposits of India ink in the whole mediastinum which was entirely black, spotlike deposits along the vertebra and smaller collections along the intercostal muscles were found. The lateral muscular portion of the diaphragm was not stained with India ink, but the central tendinous portion where it connects with the mediastinum was. These experiments suggest that although the transference of fluid from the abdominal into the pleural cavity is not obstructed from below upward, nevertheless its resorption from the pleural cavity is apparently delayed. That small corpusecular elements like carmine and India ink can be transported from the abdominal into the pleural cavity was uniformly observed by us, corroborating the well-known experiments of other authors mentioned above.

### Summary and Conclusions

1. Ascites is not a frequent occurrence in ovarian fibromas if one considers all fibromas including the small ones.
2. Ascites as well as the combination of ascites and hydrothorax (Meigs' syndrome) is also found in theca-cell tumors.
3. The ascitic fluid probably originates from the tumor itself. Geibel's observation on the oozing of fluid from an ovarian fibroma placed in a dry vessel should be verified. The conditions which may bring about a lymph congestion in the tumor should be studied by a thorough examination of the lymph and blood vessels in the tumor tissue, in the pedicle and on its surface.
4. In every case of Meigs' syndrome the specific gravity, the albumin and cell content and the osmotic pressure of the ascitic and pleural effusions should be determined.

5. Further animal experiments are necessary to establish the most favorable conditions for the occurrence of Meigs' syndrome. Experiments with the fluid found in cases of Meigs' syndrome appear to be promising.

6. The anatomic routes by which fluid is transferred from the peritoneal into the pleural cavity are described. Living cells, cell debris or chronic inflammatory changes of the peritoneum or of the pleura may block the connections between these two cavities.

7. The prevalence of right-sided pleural effusions can be explained by anatomic and physiologic conditions, i.e., the better development of the diaphragmatic lymph channels, the higher position of the diaphragmatic dome and the more intensive pumping action of the diaphragm on the right side.

8. A hydrothorax can best come about not only if the ascitic fluid is poor in colloids, and therefore can easily pass the diaphragm, but also if the absorption and deportation of the fluid is not too rapid in the pleura to prevent its accumulation.

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## **COMPARATIVE ANALYSIS OF DRUGS IN CONTINUOUS CAUDAL ANALGESIA**

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FOR almost one hundred years, attempts have been made to relieve the pain of childbirth. During this period, various methods of using analgesic and sedative drugs have been advocated. None of these drug combinations has been entirely satisfactory. The use of continuous caudal analgesia in labor and parturition as reported by Edwards and Hingson<sup>4</sup> was received with enthusiasm by the medical profession and the lay public.

Several weeks ago, we began using this new type of analgesia. Although it has thus far been impossible to carry out the procedure in a large number of cases, we have made an effort to closely supervise the patients, and to critically analyze the method in regard to its advantages and disadvantages. Particular attention has been given to two analgesic agents.

The history of continuous caudal analgesia has been adequately and completely given in many previous publications.<sup>1, 4, 5, 10</sup>

The technique that we have used was originally described by Hingson and Edwards involving the use of the malleable needle and intermittent injections of the drug.<sup>4, 5, 7, 10</sup> We have not used the alternative method devised by Adams and Lundy involving the ureteral catheter.<sup>8</sup>

Two drugs have been used with equal effectiveness, metycaine and pontocaine.\* Metycaine was used in 1.5 per cent solution in saline and pontocaine 0.25 per cent in saline and recently 0.1 per cent solution in saline combined with epinephrine in a dilution of one to 200,000. The duration of effective analgesia was of some interest. Metycaine injected in 20 c.c. or 30 c.c. amounts was effective for about thirty to forty-five minutes. Pontocaine 0.25 per cent injected in the same volume produced analgesia for forty-five minutes to one hour, and pontocaine 0.1 per cent plus epinephrine was effective for as long as one and one-half hours.

Among the 100 obstetric patients, there were three patients with pulmonary tuberculosis, three with severe pre-eclampsia, one eclamptic, and one patient with carcinoma of the breast with pelvic metastases.

### **Advantages**

Perhaps the outstanding feature noted in our cases was the small amount of bleeding in the third stage.

\*Pontocaine furnished for this study by Winthrop Chemical Company.

There was considerably more blood lost from the episiotomy wound than from the uterus in every case except one. Following one breech delivery, a postpartum hemorrhage occurred. This case offered considerable difficulty in delivery of the aftercoming head, the cord was twice about the infant's neck and undue traction was inadvertently applied to the cord. The placenta delivered rapidly and approximately 500 c.c. of blood followed it.

The remarkably good uterine tone which is maintained throughout the third stage of labor is probably responsible for the apparent diminution in blood loss. The placenta usually separates promptly, and in the majority of cases, is free in the vagina ready for simple expression by the time the operator has cared for the infant. In one case, the placenta was incarcerated by the rapidly contracting uterus and ether vapor anesthesia was necessary to complete the third stage. Coincidental with the excellent uterine tone, there was also apparent shortening of the third stage of labor. A careful analysis of our statistics, however, did not reveal a significant difference in the duration of the third stage between patients delivered under caudal analgesia, and those delivered under inhalation anesthesia.

The second most striking feature of the method is prompt spontaneous respiration in the newborn infant. This assumes particular importance in the delivery of premature infants and in cesarean sections.<sup>2</sup> We observed no asphyxia neonatorum in any of the babies.

Another feature of caudal analgesia and one which has been much publicized in the lay literature, and to which the method owes its countrywide interest, is the diminution in the intensity of labor pains. In only two of our cases was it necessary to supplement the caudal analgesia with nitrous oxide and oxygen during the delivery itself.

Our observations corroborate the impressions of others that labor should be well established when the analgesia is initiated. In our cases,

TABLE I. CLINICAL MATERIAL

PROCEDURE	ANALGESIC AGENTS USED			
	METY-CAINE	PONTO-CAINE	PONTOCAIN 0.1% WITH EPINEPHRINE 1:200,000	TOTAL CASES
Low forceps	20	19	21	60
Spontaneous	8	4	1	13
Low cervical cesarean section	2	1	5	8
Breech	1	1	1	3
Midforceps rotation	1	1	2	4
Manual rotation	5	1	1	7
Brow conversion to vertex	1	0	0	1
Hysterectomy	2	0	0	2
Salpingo-oophorectomy plus appendectomy	2	0	0	2
Hysterotomy and sterilization	0	0	1	1
Thrombophlebitis	2	1	3	6
Failure to insert needle	0	0	0	4
Total	44	28	35	111

the cervix was approximately 5 cm. dilated and the interval between pains was five minutes or less at the time the needle was inserted. When these requirements were fulfilled, labor progressed rapidly throughout the first stage. Progress became arrested, however, with complete dilatation due to lack of voluntary expulsive efforts in the second stage, necessitating operative interference in sixty-six per cent of the cases delivered per vaginam. This seemingly disagreeable feature was obviated in two ways; first, by instructing the patient in voluntary "bearing down" efforts and second, by the use of outlet forceps.

With local anesthesia over the perineum, there is complete relaxation of all supporting structures which reduces the incidence of soft part dystocia. The vagina and rectum are readily distensible and dilatation of these organs produces no pain. As a result, complete, thorough and painless rectal examinations can be made. Patients with hemorrhoids may be examined with no discomfort. The cases reported were from the ward service, and their progress in labor was followed by medical students. Many rectal examinations were done by these students in order to familiarize themselves with the progress of the parturient. Caudal analgesia permits thorough examination with no discomfort.

In common with local injection anesthesia and other regional blocks, this procedure eliminates some dangers which are inherent in any inhalation anesthesia. Aspiration pneumonia and atelectasis should not occur. The individual with pulmonary or cardiac disease is more conservatively cared for by this method. Patients may continue to take food and fluids throughout labor and immediately post partum, thereby maintaining fluid and electrolyte balance.

Those patients who have elevated blood pressure resulting from cardiovascular, renal disease or pre-eclampsia, are relieved of the exertion of the second stage of labor. Eclamptic patients may be kept perfectly quiet, and labor pains are less likely to precipitate a convulsion.

There are doubtless many other striking features in favor of this type of analgesia. The above facts have been most apparent in our observations.

#### **Disadvantages**

The unfavorable aspects may seem numerous. It is probable that we are, in part, responsible for some of the disadvantages noted. It is also probable that the disagreeable features will largely be eliminated with further knowledge, with improvements in methods, and with the development of new analgesic agents.

The possibility of dural puncture with subsequent injections of massive amounts of the drug into the subarachnoid space is ever present.<sup>9, 11</sup> If a large volume of the drug is injected intradurally, only heroic methods for maintaining blood pressure and respiration will save the patient. Methods to eliminate this danger have already been devised but no foolproof procedure has as yet been forthcoming.

Closely related to this danger symptomatically is intravenous injection or absorption.<sup>3</sup>

It is imperative, therefore, that someone relatively familiar with the procedure and capable of intelligent action be in constant attendance throughout active labor in case respiratory arrest or alarming fall in blood pressure should occur. Whereas barbiturates may be given in therapeutic amounts and the care of the patient entrusted to the usual labor-room nurse, one cannot initiate caudal analgesia and leave the patient. In teaching hospitals, where medical students are available under the supervision of trained house officers, the care of the patient offers no difficulty; for the private practitioner this constant observation of the patient is a definite problem.

In regard to the insertion of the needle, certain features are outstanding. In the very obese patients, the sacral hiatus is nearly impossible to identify and insertion is rendered exceedingly difficult. Deformities of the sacrum may even make it impossible. We were unable to properly insert the needle in four patients, including one with spina bifida. Pustules or exorciations about the buttocks, pilonidal cysts or sinuses contraindicate its use. Infection within the canal has been reported.<sup>6</sup>

Caudal analgesia produces loss of desire to void. As a result, it is necessary to aid the patient in this respect by pressure on the bladder above the symphysis in an effort to overcome the internal vesicle sphincter. Even though this is done, frequent catheterizations have to be performed and the possibility of retrograde urinary tract infection is enhanced. We observed three cases of postpartum atony of the bladder requiring active therapy and increasing the hospital stay of the patient. These three individuals received 0.25 per cent pontocaine. No postpartum atony occurred with pontocaine, 0.1 per cent with epinephrine or with metycaine.

Severe nausea and vomiting occurred in two patients who received pontocaine, and in one patient who received metycaine. These symptoms were immediately relieved following delivery of the infant.

The incidence of operative deliveries was increased by the use of continuous caudal analgesia probably as a result of the lack of expulsive efforts of the patient in the second stage.

In breech presentation because of the lack of a firm dilating wedge, and the absence of the "bearing down" sensation, the presenting part remains high and manual aid is necessary very early in the conduct of the second stage.

Finally, it should be pointed out that certain emotionally unstable individuals are exceedingly fearful of childbirth. Those who are in any way mentally unstable are very poor candidates for this type of analgesia.

#### Conclusions

1. Pontocaine 0.1 per cent with epinephrine 1 to 200,000 is a safe and satisfactory caudal analgesic agent.

2. Pontocaine 0.25 per cent and pontocaine 0.1 per cent without epinephrine have been unsatisfactory.
3. Caudal analgesia has great possibilities for use in obstetrics and in surgery of the pelvis. It is possible to relieve pains of labor during the first stage, and to produce anesthesia for delivery.
4. The baby's respiration is established immediately and no resuscitation is necessary.
5. The method is one to be used only by persons familiar with local and regional anesthesia, and aware of the dangers involved.
6. Caudal analgesia is unsatisfactory in patients with breech presentations.
7. Since the mechanism of labor is altered with the use of continuous caudal analgesia, no one should attempt to use this method unless he is familiar with the techniques of rotation of the fetal head, and the use of the obstetric forceps.

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## PLACENTAL INFARCTION AS A DIAGNOSTIC CRITERION OF MATERNAL TOXEMIA

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SINCE clinical experience has repeatedly demonstrated that the manifestations of late toxemia of pregnancy can be quickly relieved by emptying the uterus, it has been reasonable to suspect a connection between the placenta and toxemia. To this end, many have searched for placental lesions having a high degree of correlation with maternal toxemia. The lesions that have attracted the most attention have been the so-called "infarcts," a term used to include a variety of lesions. The causal relationship between placental infarction and maternal toxemia has not been generally accepted even though they are frequently associated. However, Bartholomew and co-workers<sup>1-4</sup> have stated that a high degree of correlation between certain acute infarcts and toxemia does exist, and they have presented evidence that these lesions have etiologic significance.

The work† presented here is the result of the gross examination of 640 consecutive placentas in an unsuccessful attempt to find lesions characteristic of toxemia.

Siddal and Hartman<sup>10</sup> in 1926, described four types of infarcts found in 67.7 per cent of 700 consecutive placentas which they studied. All were composed largely of degenerated villi and elements from the maternal blood. Their first three types resembled intravascular thrombosis and depended "upon stasis of the maternal blood flow in the intervillous placental space and the existence of areas denuded in some way of their anti-coagulative syncytial epithelium."

Their Type 1 infarct was described as a poorly defined or irregular, pearl-gray formation varying in size from microscopic areas to those several centimeters in width. They were not striated, and often had a mottled appearance near the outside due to the partial inclusion of small areas of normal placental tissue. Microscopically, the central portions of advanced infarcts had a solid structure composed of degenerated shadows of villi surrounded by old fibrin. Near the periphery, broad projections of fibrin extended to nearly normal villi.

Their Type 2 infarct was located usually toward the center of the cotyledon and varied in color from red, brown, or almost black to pink or brick-colored. It measured a few millimeters to several centimeters in diameter. Frequently, it was sur-

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†We acknowledge the assistance of A. G. Karlson, D.V.M., Ph.D., in preparation of the manuscript.

rounded by a pale pseudocapsule. Some were striated. Microscopic examination revealed the lesion to be composed of lamellae of fibrin and coagulated blood. They were at times found lying against Type 1 or Type 4 infarcts, but otherwise showed practically no involvement of the villi.

Their Type 3 infarct resembled Type 2, but was less dark in color due to the absence of blood pigment. Intermediate forms between Type 2 and Type 3 were seen.

Their Type 4 infarct was described as being usually near the margin of the placenta, and varying from a few millimeters in diameter to the involvement of whole cotyledons. The older forms of this type were a uniform dull white or light yellow with edges contrasting sharply with the surrounding placental tissue. The younger forms were pink, or even dark reddish-brown and were usually mottled. Microscopic sections revealed these lesions "to be composed of closely packed villi, usually, a thin layer of fibrin between." A characteristic feature was that all the villi had reached about the same degree of degeneration. In recent lesions, the syneytium and intravillous blood appeared normal with only the stroma showing degenerative changes. In older lesions, the intravillous erythrocytes were faded and disintegrated, the syneytium eventually degenerating while the stroma had lost nearly all evidence of its cellular structure.

Siddal and Hartman stated their Type 4 lesion "probably represents a simultaneous involvement of all the branches of a stem villus due to disturbance in the fetal-placental circulation." They found all types of infarction to be more frequent in placentas from cases of toxemia. In the forty-five placentas from cases of toxemia, 86.7 per cent had infarction of some type. According to types, 17.8 per cent had Type 1, 31.1 per cent had Type 2, 37.8 per cent had Type 3, while 42.2 per cent had Type 4 infarcts.

In 1932, Bartholomew and Kracke<sup>3</sup> wrote that eclampsia resulted from absorption into the maternal blood of the split products of placental protein from an acutely infarcted area. The infarcts they considered significant apparently belonged to Siddal and Hartman's Type 4. In 1936, Bartholomew and Kracke<sup>4</sup> stated that hypercholesterolemia of pregnancy was probably the fundamental basis of toxemia since its excessive storage in the placental arteries predisposed to infarction. In 1938, Bartholomew<sup>1</sup> stated: "Toxemia of pregnancy is associated with definite types of acute infarction of the placenta. In examining 'unknown' placentas, it is possible to diagnose pre-eclampsia, eclampsia, and abruptio placentae in 90 per cent of the cases." This statement was based on Bartholomew and Colvin's<sup>2</sup> work in which they examined 100 placentas grossly as unknowns from both toxemic and normal cases. They also said it was possible to predict the type of infarcts that would be found in the placenta from a knowledge of the clinical history of the pregnancy. Their 100 cases were selected and were not from consecutive deliveries. Fifty of the placentas were from normal cases, twenty-four were from cases of mild to moderate toxemia, eight were from cases of pre-eclampsia, ten were from cases of eclampsia, while two were from cases of abruptio placentae. They classified infarcts as A, B, C, D, and E in the order of increasing rapidity of in-

faretion, as well as in the order of increasing toxicity. Their descriptions are as follows (Bartholomew<sup>1</sup>):

"If infarction occurs rapidly, the affected placental tissue appears as one or more round or oval areas from one to several centimeters in diameter which are sharply demarcated from the surrounding normal placental tissue by the color, which is a dark, purple-black color. These areas correspond to the distribution of the obstructed vessel. The consistency is still spongy and soft as in normal placental tissue. When the strip is held toward the light, the infarcted area preserves a granular appearing surface. When the strip is bent, the infarcted area bends as easily as the normal tissue. There may be a soft or firm clot within, or adjacent to the area. This type of infarct is designated as the early E infarct. Clinically, the acute type of infarction is associated with the more acute, fulminating, pre-eclamptic, eclamptic, or abruptio type of toxemia, and there is a direct relation between the amount of tissue involved and the severity of the toxemia. It is usually found when the patient progresses from a normal state to pre-eclampsia, eclampsia, or abruptio placentae within a week or ten days.

"If infarction is slightly older or less acute (late E infarct), the lesion is still dark or purple-black, but has changed from a spongy to a more compact, firm area, sharply demarcated from the surrounding lighter spongy tissue. It is firmer to palpation, and when the strip is held toward the light, the surface of the lesion appears marble-like and shiny. When the strip is bent, the infarcted area either cracks sharply or holds together and does not bend with the rest of the strip. Clinically, the toxemia is almost, if not quite, as fulminating as that associated with the early E infarct. . . . If infarction is still less acute or of longer duration, corresponding to a clinical course of from two to three weeks, the infarcts vary from a faint brown (early D) to a definite brown (late D) and are sharply demarcated, firm, compact, smooth, and shiny and hold together when the strip is bent. Grossly, the more rapid the infarction, the less conspicuous the lesion, the less firm the consistency, the darker the color, and the greater the toxicity. The range in color, due to change in the hemoglobin, is from very dark purple-black in infarct E to brown in D, to brown-yellow in C, to yellow-white in B, and to white in A. The size and number of the infarcts bear a definite relation to the severity of the toxemia. Failure to appreciate the relationship between placental infarcts and toxemia of pregnancy has been due to improper preparation and examination of the placenta and lack of familiarity with the more acute types of placental infarcts."

Schumann<sup>9</sup> wrote that no distinct connection between toxemia and placental infarction could be established, and remarked that for years he had pointed out to his interns and students the absence of marked infarction in placentas from severe cases of eclampsia. Furthermore, he noted cases having striking areas of placental infarction with uneventful pregnancies.

Harer<sup>6</sup> in 1936, stated that the placental changes found in late toxemia were identical with but occurred more frequently and were more extensive than those found in clinically normal cases. He regarded maternal toxemia as an additional source of injury to an organ already undergoing the pathologic changes incidental to senility.

Tenney<sup>11</sup> in 1936, reported that moderate syncytial degeneration was present in mature normal placentas. In placentas from cases of severe toxemia or eclampsia, the syncytial degeneration was sufficiently

marked as to be of diagnostic value. In 1940, Tenney and Parker<sup>12</sup> stated that toxemia could be accurately judged by placental histopathology.

Hunt, Patterson and Nicodemus<sup>8</sup> in 1940, stated "early in a study of this kind one may become discouraged because grossly the placenta may show very little. This is often true even after fixation." However, after studying 180 placentas microscopically and adding the findings to those of the gross examination, they believed placental lesions of vascular origin were "primary" in the production of late toxemia.

It is our opinion that no conclusions regarding the presence or absence of maternal toxemia may be drawn from gross examination of the placenta, even though it has been well fixed. We arrived at this conclusion after gross examination of 640 placentas and studying the clinical record of each case.

After we had examined several hundred placentas, we were impressed by the fact that the cut section in some instances was light brown in color, while in others, it was a dark, purplish-brown, the difference in color being due to the amount of blood contained in the specimen. The dark placentas represented congestion. We were thus able to divide our specimens into three groups depending on the appearance of the cut section after fixation, i.e., (1) light, (2) medium, (3) dark. The practical importance of investigating the causes of the different colors was that Bartholomew and Colvin apparently identified their E infarcts chiefly by their color. In the majority of cases, their anatomic diagnosis of toxemia was made on the identification of the E and D infarcts. Obviously the E and even the D infarcts, would be difficult to see in a dark congested placenta.

In 1936, Harer<sup>6</sup> found congestion in 25 per cent of his series and discussed the cause and prevention of the condition. He stated "the majority of these cases are caused by interference with the maternal blood supply to the placenta and are due to a reduction in the area of the placental site." He thought that in most cases congestion occurred late in labor, or even after birth of the child and was apparently without effect on the mother or child. Among the mechanisms he thought might produce this condition was that the contracting uterus might compress the thinner-walled uterine veins before the thicker-walled arteries could be completely shut off. In forty-three cases he managed the third stage of labor as follows: The umbilical cord was cut and the placental end allowed to drain. No oxytocics were administered, and the uterus was not touched until definite evidence of placental separation was observed. In none of these cases did he find an instance of passive congestion.

In a small series of twenty-five cases, we found that allowing the umbilical cord to drain prevented the occurrence of placental congestion.

#### Materials and Methods

Six hundred and forty placentas obtained from women delivered in the hospital provided the material for this study. Within one to two

hours after delivery, the placentas were placed in 4 per cent formaldehyde solution and sent to the laboratory where the membranes were removed and excess blood wiped off. The specimens were fixed in 10 per cent formaldehyde solution for four to six weeks, and then cut into strips about one centimeter wide. The presence and extent of certain kinds of infarcts were observed, and on this basis a diagnosis of "toxemia," "questionable toxemia" or "no toxemia" was made. The diagnosis was then checked at once with the clinical record. Special attempts were made to identify the acute E infarct of Bartholomew.

A persistent hypertension of at least 140/100 which fell to within normal limits after delivery, albuminuria and edema all in the last trimester of pregnancy constituted our clinical criteria of toxemia. Forty-two or 6.5 per cent of the 640 cases were toxemias, and five or about 0.8 per cent were eclampsias. Blood pressure determinations were routinely made in all cases during labor until delivery. We did not encounter any proved cases of nephritis.

Siddal and Hartman's Type 1 and Type 4 infarcts both involve necrosis of placental villi whereas their Type 2 and Type 3 do not. We therefore selected the former two types of infarcts as our anatomic basis of diagnosing toxemia. We also attempted to use Bartholomew and Colvin's E infarct as a criterion for the anatomic diagnosis of toxemia. Areas of infarction less than one centimeter in diameter were arbitrarily disregarded except in the rather infrequent placentas containing a great many such small lesions.

### Results

We diagnosed toxemia correctly in only eight or (19 per cent) of the forty-two placentas from cases of toxemia. The diagnosis was questionable in seven (16 per cent), while twenty-seven (64 per cent) of these forty-two placentas were passed by us as showing no more infarction than our normal placentas. Thirteen (2 per cent) of our 598 placentas from normal pregnancies revealed sufficient infarction to cause us to wrongly diagnose toxemia. Of the five placentas from cases of eclampsia, three were diagnosed as "questionable toxemia," while two were passed as normal.

From these data, it is evident that we could not recognize lesions characteristic of maternal toxemia by gross examination of the placenta.

We failed to identify to our complete satisfaction the acute kind of lesion which Bartholomew and Colvin<sup>2</sup> described in their placentas from cases of toxemia.

### Placental Congestion

We have pointed out the desirability of having placentas free from congestion since congestion may mask the acute infarcts described by Bartholomew and Colvin.<sup>2</sup> Acting on Harer's<sup>6</sup> belief that congestion

depended on the manner in which the third stage of labor was managed, we studied 125 placentas from two standpoints.

We determined first, the effect of administering pituitrin at the end of the second stage of labor upon the incidence of congestion of the placenta. One hundred cases were studied of which fifty-four received pituitrin at the end of the second stage, while the remaining forty-six received no pituitrin during labor. The placentas were classified as "light," "medium," or "dark" depending on the appearance of the cut section. Of the forty-six placentas from cases receiving no pituitrin, fifteen (33 per cent) were "light," seventeen (37 per cent) were "medium," while fourteen (30 per cent) were "dark." Of the fifty-four placentas from cases receiving pituitrin, twenty-two (40 per cent) were "light," twenty (38 per cent) were "medium," while twelve (22 per cent) were "dark." These results are summarized in Table I. It is evident that the giving or withholding of pituitrin had no significant effect on the incidence of congestion of the placenta.

TABLE I. THE EFFECT ON THE COLOR OF THE PLACENTA OF GIVING PITUITRIN OR DRAINING THE UMBILICAL CORD

	PITUITRIN GIVEN	NO PITUITRIN	UNBILICAL CORD DRAINED
	54 Cases	46 Cases	25 Cases
Light placentas	22	15	21
Medium placentas	20	17	4
Dark placentas	12	14	0

We next determined the effect of allowing the umbilical cord to drain free of blood as soon as possible after birth of the baby. While we were able to secure only twenty-five cases in which this was done, the results were striking. Twenty-one (84 per cent) were "light," four (16 per cent) were "medium," while none was "dark." These results are also summarized in Table I. It is suggested that allowing the umbilical cord to drain may be of value in avoiding or lessening passive congestion of the placenta.

#### Comment

In a study of this kind, we are convinced of the necessity of using unselected cases. In our series, the incidence of placentas from cases of toxemia was only 6.5 per cent. Furthermore, the abnormal ones were not regularly encountered. We would examine at times as many as thirty placentas from clinically normal cases before encountering one from a case of toxemia. If one were to examine a selected series of placentas in which half were from cases of toxemia, the possibility of picking out such placentas would be greatly increased by chance alone as compared to a group of consecutive unselected cases.

We cannot explain our failure to find the acute infarcts described by Bartholomew and Colvin<sup>2</sup> in the placentas from cases of toxemia.

Although placental congestion might obscure this lesion, it is unlikely that congestion occurred in all our placentas from cases of toxemia. While twenty-five cases are not enough on which to base a conclusion, we suggest that the umbilical cord be drained to prevent masking of a lesion by congestion.

Haselhorst and Allmeling<sup>7</sup> found that the average amount of blood in the placental vessels of 120 infants was 104 cubic centimeters. They showed that 51 per cent of this flowed into the infant from the placenta in the first minute after delivery, 79 per cent reached the child in the first five minutes, and 91 per cent in the first ten minutes. DeMarsh, Alt and Windle<sup>5</sup> collected and measured the blood in ten placentas at the end of pulsations (about three minutes after birth), and the amounts averaged 62.4 cubic centimeters. They stated: "A delay on the part of the obstetrician in clamping the cord, not only until pulsations cease but also until the placenta has separated from the uterus, will give the newborn infant the quota of blood that naturally belongs to him." From these observations we suspect that the placenta will be congested in cases where the cord is clamped immediately. Congestion of the placenta may be avoided by delay in clamping the cord as well as by allowing it to drain.

It was of interest to discover the nearly identical incidence of toxemia and eclampsia in Siddal and Hartman's<sup>10</sup> series, and in the series we are reporting. Both were consecutive series of cases delivered in the hospital. Their series had forty-five cases of toxemia (6.4 per cent) of the total 700 cases. Our series had forty-two cases of toxemia (6.5 per cent) of the total 640 cases. In each series there were five cases of eclampsia.

#### Summary and Conclusions

The placentas from 640 consecutive deliveries were fixed in 10 per cent formaldehyde solution for four to six weeks, and then examined grossly for certain infarcts involving necrosis of the villi. Forty-two placentas were from patients with a definite clinical picture of toxemia.

Examining them all as unknowns, only eight of these forty-two placentas from cases of toxemia had such infarcts extensive enough to distinguish them from placentas of nontoxemia cases. Thirteen of the 598 placentas from patients with normal pregnancies showed infarcts like the eight from cases of toxemia.

We were unable to satisfy ourselves that we could recognize the acute type of infarct described by Bartholomew and co-workers as being associated with toxemia.

In twenty-five placentas, the cord was drained. There were no instances of congestion when this was done. Administration of pituitrin at the end of the second stage of labor did not affect the incidence of congestion. Congestion might obscure some placental infarcts.

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## THE APPLICATION OF THE BRAXTON HICKS VERSION IN MODERN OBSTETRICS

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**I**N MEDICINE, certain procedures have frequently been lost with the passing of years, and on occasion, their value has not been sufficiently appreciated. The operation of bipolar version as first advocated by J. Braxton Hicks<sup>1</sup> appears to fall into such a category. With the advent of anesthesia and asepsis, it is possible to offer certain modifications to the original operation. Furthermore, improved techniques have been developed since the advent of the original monograph. It is, therefore, appropriate to reconsider and attempt to re-evaluate this operation in accordance with the progress of obstetrics.

In many of our present textbooks on obstetrics, we find this operation limited, for the most part, to the treatment of placenta previa. Irving,<sup>2</sup> in advocating the operation, described the technique, emphasized the technical difficulties encountered, and reported the results in a series of patients composed primarily of individuals who developed severe antepartum bleeding in the last trimester of pregnancy. Most of the cases were patients with placenta previa and a smaller group with premature separation of the normally implanted placenta. The procedure was used when the babies were nonviable, extremely premature, or dead at the time of operation. He suggested that the operation was applicable to other groups of cases, particularly to patients with severe preeconvulsive or convulsive toxemia where the babies were very premature or the operation of abdominal hysterotomy was too great an operative risk for the mother.

In his original monograph "On Combined External and Internal Version," published in 1864, J. Braxton Hicks presented twenty-four cases treated by this operation which now bears his name. About 50 per cent of the cases in his report were patients with placenta previa. Ten of the remaining cases were actually individuals with cephalopelvic disproportion, with over half of the infants presenting in a transverse position. There was one patient who had eclampsia, and two cases in which the cord had prolapsed. Naturally, with the advent of cesarean section since that time, many of the conditions he reported would have been treated by this surgical procedure. Hicks was conscious of two principles which must be adhered to in order to facilitate the successful performance of his operation, namely:

1. The desirability of intact membranes, or, if not intact, the rupture of the membranes should have occurred only recently.

2. Once the baby is turned, and a foot is brought through the partially dilated cervical os, delivery should depend only upon the natural forces of labor.

This report is concerned with further experience with this operation. We believe that its usefulness can be applied to patients with pregnancy toxemia, abnormal presentation of the fetus, malformation of the fetus, as well as to patients with late antepartum vaginal hemorrhage. Experience has taught us that certain modifications, added to the operation, simplify the technique.

#### **Antepartum Bleeding in the Last Half of Pregnancy**

It is the general policy of this clinic to deliver patients with placenta previa (marginal and partial) by the vaginal route, if the baby has little chance of survival.<sup>3</sup> Although, occasionally, we have successfully delivered patients with central previa by the vaginal route, we do not recommend this treatment as a routine procedure. Many of these cases were treated directly with bipolar version, while others were first treated with a Voorhees bag if the cervical os was one finger or less dilated.

When the latter procedure is necessary, the question arises whether this form of cervical tamponade is most effective, if the bag is placed within or outside the amniotic sac. There are certain advantages to either method. Those who advocate the intraovular insertion of the bag believe this method is necessary for the proper control of the bleeding. One must concede that the bleeding is better controlled if such an insertion can be accomplished. However, this is not always possible, for, not infrequently, the placenta detaches itself from the uterus by the force of the clamp as it attempts to burrow through the placenta in order to insert the bag within the ovum. This accident may initiate such a degree of immediate hemorrhage that, often, the operator will have to be satisfied with an extraovular insertion. Although the placenta is thus separated from its site, immediate inflation of the bag will cover the maternal sinusoids with subsequent thrombosis. Therefore, only a modicum of hemorrhage can occur. However, as labor progresses and the cervix becomes further dilated, the bag will not rest firmly against the lower segment and consequent bleeding may ensue. Hence, a good sense of timing is necessary in removing the bag and performing the bipolar version, if one is to maintain minimum blood loss.

In addition, two other advantages can be considered when the insertion of the bag is extraovular. First, if the membranes are kept intact, they will form an important barrier against intraovular infection, and, second, the preserved fluid of the intact amniotic sac will allow the uterus to be relaxed and moist for performing the bipolar version.

#### **Pregnancy Toxemias**

The toxemias of pregnancy are a disease occurring chiefly in the latter half of gestation. Frequently, termination of the pregnancy is

mandatory if one is to serve the best interests of the mother. It has been generally accepted that artificial termination of pregnancy, pelvically, from the twentieth through the thirty-fifth week, can be unsatisfactory and often hazardous. The nonirritability of the uterus at this time does not augur well for the production of effective labor by simple rupture of the membranes. Also, noneffacement and lack of dilatation of the cervix present impediments to effectual labor. The latent period following artificial rupture of the membranes, in such cases, may consume days or even weeks before labor ensues, thereby augmenting the risk to patients with severe pregnancy toxemia in at least two ways: (1) the increase in the severity of the disease before the uterus is successfully emptied of the products of conception, and (2) the danger of severe intrapartum and postpartum uterine infections.

The following forms of treatment have been advocated for the termination of pregnancy during this period:

1. *Bougies*.—The same criticism relative to the simple rupture of the membranes appears valid, in addition to the danger of traumatic separation of the placenta.

2. *Vaginal Hysterotomy*.—Certainly, the trauma and blood loss are too unpredictable for one to recommend the operation as a routine procedure. This is especially true if the patient is a primipara where technical difficulties associated with inadequate operative exposure may be encountered. The application of this operation should be restricted, for the most part, to multiparous patients in the middle trimester of pregnancy.

3. *Abdominal Hysterotomy*.—This appears to be an extremely radical policy, particularly in patients with severe pregnancy toxemia. Furthermore, the jeopardy to such patients for future childbearing, with the presence of a uterine scar, is certainly increased.

4. *A Voorhees Bag*.—This has always been considered a moderately effective means of inducing labor. However, it may fail. In order to insure against such failure, we recommend:

5. *Bipolar Version (Braxton Hicks)*.—This operation, with or without the use of the bag, is advised:

(a) In cases with severe pre-eclampsia where the baby has a small chance of survival because of prematurity and especially if the patient's toxemic state is rapidly progressing toward eclampsia. Cesarean section is restricted to patients in this group when the baby is not premature and the cervix is not favorable for successful induction of labor by artificial rupture of the membranes, or to cases with definite cephalopelvic disproportion.

(b) In patients with eclampsia, regardless of the maturity and condition of the baby if the cervix is not favorable for induction by artificial rupture of the membranes. The increased peril of an abdominal procedure should be avoided, if possible, even if it means increased infant

mortality. A section is performed only rarely on the eclamptic patient who has definite cephalopelvic disproportion and whose condition is not critical.

It is the routine of this clinic to treat patients in these two groups medically for twenty-four to seventy-two hours until their pulse and blood pressure become stabilized, and their general condition is improved. After such a regimen, further delay is not advisable and evacuation of the uterine contents should be started.

The patient is then anesthetized and prepared for a sterile vaginal examination. The proper instruments should be in readiness for the insertion of the Voorhees bag. If, happily, the cervix is found to be dilated one and one-half fingers or more, immediate Braxton Hicks version can be performed in the classical manner. Frequently, a sponge forceps is used to gently ease the baby's foot through the cervix. This will not place any undue tension on the cervix, in contrast to the possible trauma engendered by bringing simultaneously through the cervix the fetal foot and the two fingers grasping it. When bleeding is not a problem, a weight on the infant's foot is unnecessary. The case, then, is deferred to nature.

On the other hand, if the cervix is not found to be effaced or dilated, a small Voorhees bag is inserted. Occasionally, it will be necessary to dilate the cervix gently with a dilator to permit the introduction of the bag. We have found that a small bag, a No. 2, is more effective than a large one. After the bag is properly inflated, the stem is tied and left within the vagina to prevent contamination. A sulfanilamide gauze strip is packed lightly into the vagina.

The bag is allowed to remain in place for twenty-four to thirty-six hours. During that time indefinite uterine contractions are observed. Although labor often is desultory, the cervix does become effaced and at least one and one-half to two fingers dilated. The bag is then removed. The membranes are artificially ruptured. If the breech is presenting, a foot is brought through the cervix. If the vertex is presenting, a bipolar version is performed, and the ease is left to the natural birth processes. Once a foot is brought through the cervix, effective contractions quickly follow.

At this time, we must emphasize two additions to the technique which, we believe, will lend to the ease of performance:

*First*, great care is taken *not* to rupture the membranes when the bag is being introduced.

*Second*, the fetus is converted into a breech presentation by an external podalic version. Usually, this maneuver is executed following the insertion of the bag while the patient is still under anesthesia. The upward displacement (by the bag) of the vertex facilitates the external version. When the bag is removed, the fetus will be presenting by the breech. Simple rupture of the membranes usually will allow the infant's feet to drop near the internal os and a foot can be easily extracted.

### Malpositions

In his original monograph, Braxton Hicks realized the value of his bipolar version in correcting, partially, the malposition of the fetus if it presented in the transverse position. Unfortunately, marked pelvic contractures were included in many of his cases, and although the mothers were safely delivered, the babies were lost. Certainly, a cesarean section would have been the treatment of choice in most of those patients.

Although it cannot be stated that bipolar version is the policy pursued in this clinic in treating the patients with transverse positions, we believe that it does have a limited use in selected cases. Teel, in this clinic, advocated its use in women who had borne many babies, in whom the transverse position of the fetus appeared to occur only because of marked relaxation of the patient's abdominal wall and uterus. Certainly, the operation is of little value in primiparous women at term when the cephalopelvic relationship cannot always be determined with accuracy. In these cases, a high fetal mortality will attend any type of pelvic procedure.

It is interesting that, until two or three decades ago, bipolar version was used many times for the correction of this type of abnormal presentation. Later, it was discredited because of the high fetal mortality which attended the operation. Undoubtedly, such a high fetal mortality was a result of the fact that many times the operator did not allow the patient to continue in labor, once a foot was brought down. Rather, immediate extraction was performed in the presence of the partially dilated cervix. This resulted in the usual disastrous consequences to both mother and child.

Certain aspects pertinent to the use of bipolar version arise in these cases. If the patient is observed in early labor, external cephalic version may be attempted with fair success. If this fails, the question always arises whether it is better to insert a Voorhees bag, with the hope of keeping the membranes intact rather than allow the membranes to rupture prematurely during labor, with a subsequent dry uterus. Version, in such circumstances, often imperils both the mother and infant. Therefore, there is considerable merit in preserving the membranes by mechanical means, if possible, at least until two to three fingers' dilatation of the cervix is obtained. The bag then can be removed, a bipolar version performed, and the case left to the natural forces of labor. Likewise, if the membranes rupture spontaneously, immediate vaginal examination should be performed. If the cervix is sufficiently dilated, it would seem wiser to perform bipolar version at this time rather than later, when the uterus becomes dry and tightly contracted about the fetus.

Undoubtedly, the question of increased fetal mortality will be raised. This objection is more theoretical than real. Bipolar version, in these

cases, does not interfere with the fetal circulation, as in placenta previa. Following the version, the fetus actually assumes only the mortality of a single footling breech presentation. Certainly, one would not be concerned if a patient began labor with this type of presentation. When the cervix becomes dilated, routine breech extraction can be performed.

### **Malformations**

In malformations of the fetus, complications may arise in the actual mechanism of labor and delivery. This is particularly true in cases of hydrocephalic or anencephalic monsters. Spontaneous rupture of the membranes, especially when hydramnios is present, may result in separation of the normally implanted placenta because of the sudden release of intrauterine pressure. Furthermore, complete dilatation of the cervix will not occur because of the lack of conformity of the infant's presenting part to the lower uterine segment.

We can prevent spontaneous rupture of the membranes and possible subsequent separation of the placenta by the insertion of a small Voorhees bag. If the case is one of hydrocephalus, the bag can be removed when the cervix is one-third or more dilated. The membranes can be ruptured and the liquor amnii allowed to escape slowly. Thus, with a moist uterus, the hydrocephalic head can be perforated and a Braxton Hicks version performed. One only has to recall the unsatisfactory operation of craniotomy on such friable skulls to appreciate the value of this procedure. Likewise, confidence of a prompt and safe delivery of a patient with an anencephalic monster can be assured by the Braxton Hicks operation.

Postpartum hemorrhage due to uterine atony is always an increased hazard in these cases. Overdistention of the uterus is the potential causative factor. Normal uterine tone is best regained by slow decompression of the uterus rather than by sudden release of the intrauterine pressure. This can be effected by the restrained release of the liquor amnii, achieved by the "stopper effect" of a small Voorhees bag. Gradual extrusion of the fetus following bipolar version further enhances this slow decompression.

### **Indications**

One hundred and ten Braxton Hicks versions were done at the Boston Lying-in Hospital between 1930 and 1942, inclusive. The indications, morbidity, and maternal mortality are tabulated (Table I). Twenty-two patients were febrile following delivery, establishing a morbidity rate of 20.0 per cent. The two maternal deaths result in a mortality rate of 1.8 per cent for the series.

*Antepartum Bleeding.*—There were fifty-one cases of antepartum bleeding treated by this method. The results are listed in Table II.

The degree of placenta previa was not a contraindication for this method of treatment when the infant had little chance of survival. The

TABLE I. INDICATIONS FOR TERMINATION OF PREGNANCY AND RESULTS

INDICATION	NUMBER OF CASES	FEBRILE PUERPERIUM	MATERNAL DEATHS
Eclampsia	7	2	1
Severe pre-eclampsia	28	3	1
Placenta previa (all types)	35	7	0
Premature separation of placenta	16	5	0
Transverse presentations	10	2	0
Hydramnios with fetal abnormalities	8	2	0
Chronic nephritis	4	0	0
Miscellaneous	2	1	0
Total	110	22 (20%)	2 (1.8%)

TABLE II. ANTEPARTUM BLEEDING CASES

	NUMBER OF CASES	PRIMIP-ARAS	MULTIPI-ARAS	BAG	TIME IN HOURS BETWEEN VERSION AND DELIVERY	MATERNAL	
						FEBRILE PUERPERIUM	DEATHS
Placenta previa (all types)	35	5	30	7	4.5	7	0
Premature separation of placenta	16	3	13	2	7.5	5	0
Total	51	8 (15.7%)	43 (84.3%)	9	6.4	12	0

results obtained in these cases are exhibited in Table III. Since most of the patients were multiparas, their cervicis were sufficiently dilated at the time of examination to allow for immediate version. It was necessary to use the bag only in nine cases. The bag was placed extra-ovularly in every case with satisfactory results.

TABLE III. BRAXTON HICKS, FOR COMPLETE PLACENTA PREVIA

NUMBER OF CASES	PARITY	WEEKS PREGNANT	BAG	TIME BETWEEN VERSION AND DELIVERY		FEBRILE PUERPERIUM	DEATHS	OUTCOME OF INFANT
				HOURS	MINUTES			
1	ii	20	No. 3	23	0	0	0	Nonviable
2	vi	16	0	3	0	0	0	Nonviable
3	ii	36	0	0	30	0	0	Stillborn
4	x	27	0	3	0	0	0	Nonviable
5	iv	26	0	16	0	1	0	Nonviable
6	iii	34	No. 4	7	0	0	0	Stillborn
7	ix	31	0	3	30	1	0	Stillborn
8	i	31	0	3	30	0	0	Stillborn

Accouchement forceé should never be employed when the Braxton Hicks version is performed because there is too much danger of rupturing the lower uterine segment. This accident occurred once in this series. The occasion for therapeutic interruption was persistent vaginal bleeding in a 36-year-old para viii, 28 weeks pregnant. Since the cervix was only one finger dilated, the Goodell dilator was used and a foot was

brought down. Subsequently, the patient went into shock. Four blood transfusions were given, and immediately after pelvic delivery, a supravaginal hysterectomy was performed. A rupture of the left lower uterine segment was found. It is quite obvious that the insertion of a small bag, with subsequent bipolar version, would have prevented this serious accident.

Bipolar version was performed in sixteen cases of severe toxic separation of the placenta, without any deaths. However, we believe that this operation adds little to the successful termination of pregnancy for this grave obstetrical complication. Artificial rupture of the membranes, with the application of a Spanish windlass type of abdominal binder, is all that is necessary to properly control the bleeding. This can be done without the administration of an anesthetic. Because most of these patients are nearer term than the patients with placenta previa, labor usually begins soon after this procedure. Attempting to hasten such a process by performing a Braxton Hicks version, which necessitates the administration of a deep inhalation anesthetic, further jeopardizes the recovery of a patient who already is suffering from some degree of shock.

*Toxemias of Pregnancy.*—The results in cases of severe pre-eclampsia and eelampsia are listed in Tables IV and V, respectively. The bag was used in over 75 per cent of the cases. This was necessary because the patient was either late in the middle trimester, or in the early part of the last trimester of pregnancy. Hence, the cervix was not dilated sufficiently to perform an immediate Braxton Hicks version. Simple rupture of membranes in this group would not have insured labor or delivery within a reasonable time. The average time from bipolar version to delivery for this group was 8½ hours.

TABLE IV. HYPERTENSION AND/OR ALBUMINURIA OF PREGNANCY, SEVERE PRE-ECLAMPSIA

	NUMBER OF CASES	AVERAGE WEEKS PREGNANT	ALBUMIN	BLOOD PRESSURE		DILATATION OF CERVIX IN FINGERS	BAG	AVERAGE TIME IN HOURS BETWEEN VERSION AND DELIVERY	FEBRILE PUERPERIUM	DEATHS
				SYSTOLIC	DIASTOLIC					
Primipara	10	28.0	3 to 4+	160 240	110 100	0 to 1	10	11.5	0	0
Multipara	18	28.5	3 to 4+	150 228	100 118	1	11	10.5	2	1
Total	28	28.3	3 to 4+	150 240	100 118	--	21	10.9	2	1

There were two maternal deaths in this entire series. Both occurred in the toxemic group. One patient was delivered by the use of a bag

and Braxton Hicks version and succumbed to eclampsia on the third postpartum day. She was in deep coma throughout her hospital course. Even if pregnancy had been terminated more promptly by cesarean section, it is doubtful that she would have survived. The second death occurred in a patient with severe pre-eclampsia who died from a large pulmonary embolus on the tenth postpartum day. This was verified at necropsy.

TABLE V. HYPERTENSION AND/OR ALBUMINURIA OF PREGNANCY ECLAMPSIA

	NUMBER OF CASES	WEEKS PREGNANT	PARITY	MAXIMUM BLOOD PRESSURE	MAXIMUM ALBUMIN	DILATATION OF CERVIX IN FINGERS	BAG	TIME BETWEEN VERSION AND DELIVERY		FEBRILE PERIOD	DEATHS	OUTCOME OF INFANT
								Hours	Minutes			
1	24	6	200/130	4+	1.5	0	No. 4	7	30	0	0	Nonviable
2	26	1	145/ 90	4+	0	1	No. 3	0	30	1	0	Nonviable
3	37	1	160/ 98	4+	1	1	No. 4	20	0	0	0	Stillborn
4	28	16	260/110	4+	1	1	No. 4	3	30	0	0	Stillborn
5	34	1	210/130	4+	0	0	No. 2	2	0	0	0	Stillborn
6	34	1	210/110	4+	1	1	No. 4	4	30	1	1	Stillborn
7	26	1	180/130	4+	0	0	No. 2	5	0	0	0	Nonviable

*Transverse Presentations.*—Ten patients in this group were treated by Braxton Hicks version (Table VI). There was only one primipara and she had a nonviable infant. The metreurenynter was used in only one instance, as most of these patients entered the hospital in active labor, and the cervix permitted immediate Braxton Hicks version. The average time from version to delivery was 6 hours. The two patients who had stillborn infants also had marginal placenta previas.

TABLE VI. TRANSVERSE PRESENTATIONS

	NUMBER OF CASES	PROLAPSED CORD OR ARM	BAG	AVERAGE TIME IN HOURS BETWEEN VERSION AND DELIVERY	MATERNAL MORTALITY	MATERNAL MORBIDITY
Primipara*	1	0	0	2	0	0
Multipara	9	1	1	7.5	0	2
Total	10	1	1	6	0	2

\*Nonviable infant.

*Viable Infants.*—Of the one hundred and ten patients interrupted by Braxton Hicks version, fifty-seven had viable infants (Table VII). All patients who were 28 weeks pregnant or more by dates were considered to have viable infants, regardless of the weight of the child. This series represents many patients who were only 28 weeks pregnant or slightly over. Five infants were dead on admission. Eight patients delivered fetal monstrosities. There were twenty-three stillborn in-

fants (mostly fetuses of 28 weeks' gestation) and nine neonatal deaths. Twelve infants survived. The gross fetal mortality rate is 78.9 per cent. Excluding the five infants dead on admission and the eight fetal monstrosities, the corrected fetal mortality is 72.7 per cent. We consider this salvage good, particularly since this type of operation is not employed in the interest of the baby, except in the cases with transverse presentation.

TABLE VII. FETAL MORTALITY, BY INDICATION

INDICATION	TOTAL VIABLE INFANTS	DEAD ON ADMIS- SION	STILL- BORN AND NEO- NATAL DEATHS	FETAL MORTALITY IN PER CENT	
				GROSS	COR- RECTED
Eclampsia	4	0	4	100.0	100.0
Severe pre-eclampsia	16	2	10	75.0	71.4
Placenta previa (all types)	11	1	9	90.9	90.0
Premature separation of placenta	6	1	4	83.3	80.0
Transverse presentation	9	0	3	33.3	14.2
Hydramnios with fetal monstrosi- ties	8	0	8	100.0	100.0
Chronic nephritis	2		2	*	*
Miscellaneous	1	1	0	*	*
Total	57	5	40	78.9	72.7

\*Small figures for rates.

It is interesting to compare the fetal mortality of the various groups:

1. The corrected fetal mortality rate in the antepartum bleeding cases is 80.0 per cent for seventeen viable infants (Table VIII). One infant was dead on admission, and one had multiple congenital defects. Only two infants survived.

TABLE VIII. FETAL MORTALITY IN ANTEPARTUM BLEEDING CASES

TYPE OF CASE	TOTAL VIABLE INFANTS	DEAD ON ADMIS- SION	STILL- BORN	NEO- NATAL DEATHS	FETAL MORTALITY IN PER CENT	
					GROSS	COR- RECTED
Placenta previa	11	1	7	2	90.9	90.0
Premature separation of placenta	6	1	3	1	83.3	80.0
Total	17	2	10	3	88.2	86.6

2. The corrected fetal mortality rate in the toxemic group is 77.8 per cent (Table IX). None of the infants of the eclamptic patients survived. Four of the infants in the severe pre-eclampsia group survived. Two infants were dead on admission.

TABLE IX. FETAL MORTALITY IN TOXEMIAS

TOXEMIA	TOTAL VIABLE INFANTS	DEAD ON ADMIS- SION	STILL- BORN	NEO- NATAL DEATHS	FETAL MORTALITY IN PER CENT	
					GROSS	COR- RECTED
Eclampsia	4	0	4	0	100.0	100.0
Severe pre-eclampsia	16	2	6	4	75.0	71.4
Total	20	2	10	4	80.0	77.8

3. The corrected fetal mortality in the transverse presentation series for nine viable infants is 14.2 per cent, after excluding two stillborn infants delivered from patients with marginal placenta previa (Table X).

TABLE X. FETAL MORTALITY IN TRANSVERSE PRESENTATION

	TOTAL VIABLE INFANTS	DEAD ON ADMIS- SION	STILL- BORN	NEO- NATAL DEATHS	FETAL MORTALITY IN PER CENT	
					GROSS	COR- RECTED
Multiparae only	9	0	2	1	33.5	14.2*

\*Excluding two stillborn infants delivered from patients with marginal placenta previa.

### Comment

The obstetrician is frequently confronted with the problem of termination of pregnancy in the latter months of gestation. The complications arising at this time usually entail considerable risk to the mother. Furthermore, salvage of the infant must oftentimes be considered. Good judgment and careful discernment are essential if the best interests of both are served to the fullest extent.

Many times the mother is subjected to the risk of a major abdominal procedure in the hope of obtaining a baby whose chance of survival is minimal. Prevalence of this attitude is exemplified in the results of an extensive state-wide survey presented by De Normandie.<sup>4</sup> The mortality rate of infants delivered by means of cesarean section was 26.1 per cent. The maternal mortality rate which accompanied such a procedure was 11.7 per cent.

We realize that a fixed general policy for the proper treatment of such cases cannot be established, because even in obstetric clinics such uniformity of opinion does not exist. However, the obstetric surgeon should be versatiley prepared to effect pelvic delivery in all obstetric complications where the viability of the infant is questionable. Therefore, we feel that the Braxton Hicks combined internal and podalic version is an operation which should be revived. It can be utilized not only for certain types of placenta previa but for various groups of cases, such as, severe toxemias of pregnancy, transverse positions, and hydramnios with certain types of monstrosities. In the hands of an experienced operator and with modifications in technique, seriously ill obstetric patients can be delivered safely.

### Conclusions

- One hundred and ten cases of Braxton Hicks combined internal and external versions were performed at the Boston Lying-in Hospital during an interim from 1930 through 1942.
- The gross maternal mortality rate is 1.8 per cent. The morbidity rate is 20.0 per cent.

3. The gross fetal mortality rate is 78.9 per cent for fifty-seven viable infants; corrected, 72.7 per cent.
4. Certain modifications in technique are presented which, we believe, will: (1) simplify the operation, and (2) lower the morbidity rate.
5. We recommend the use of the Braxton Hicks bipolar version in patients with (1) *Placenta previa* (marginal and partial), when the infant has little chance of survival; (2) *Pregnancy toxemias* (a) in severe pre-eclampsia, when the infant is nonviable or extremely premature; (b) in eclampsia, regardless of the infant's condition (except when cephalopelvic disproportion is present). (3) *Transverse presentations*, particularly in multiparas who have living children. (4) *Hydramnios* with fetal monstrosities.

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## TWIN PREGNANCIES WITH ONE TWIN BLIGHTED

### Report of Two Cases With Comparative Study of Cases in the Literature

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THE birth of a viable twin at or near term accompanied by the birth of a blighted fetus younger than the seventh month of gestation has been known for many years. Reference to such occurrences have been made in practically all of the older handbooks of midwifery, such as Guillemeau (1594),<sup>30</sup> Peu (1694),<sup>57</sup> Mauriceau (1695),<sup>38</sup> Chapman (1735),<sup>38</sup> Burton (1751),<sup>38</sup> Smellie (1752),<sup>38</sup> Albert Haller (*Elements of Physiology*, 1780),<sup>41</sup> Denman (1821),<sup>38</sup> Dewees (1833),<sup>139</sup> Velpeau (1838),<sup>170</sup> Cruveilhier (1842),<sup>117</sup> and Krause (1853).<sup>71</sup> Ramsbotham<sup>110</sup> says that this condition was remarked upon by Pliny. Despite the availability of this knowledge, many references to such occurrences during the last century are in the form of letters to the editors of medical journals briefly reporting such cases and asking for information concerning them. Examination of such brief reports supplies information primarily concerning the kind of labor, and secondarily the character of the dead fetus. Sometimes the age of the fetus was estimated, the age and parity of the mother were given together<sup>o</sup> with a brief note on the character of the placenta and the umbilical cord. Occasionally, the sex, size and weight of the viable twin were given with the relative time of birth. In a number of cases, only the placenta and the dead twin were presented and described. One of the earliest comprehensive studies on the subject was presented for the doctorate of medicine at the University of Amsterdam by Luber<sup>86</sup> in 1811.

Dupoux<sup>34</sup> was probably the first to examine a part of the necrotic placenta under the microscope and report his findings. Following this time more attention was paid to the pathology of the placenta and with the introduction of the x-ray, determination of the age of the dead fetus as judged by the degree of ossification as well as by measurement was frequently reported. During the latter part of the nineteenth and the beginning of the present century cases were gathered to be used as theses. But in none of these theses was there a comprehensive survey in which the accumulated data were analyzed from quantitative as well as qualitative points of view.

In the present paper, I propose to give a brief description of two cases of this kind and, using these cases as a background, to present a quantitative and qualitative analysis of such data as have been available to me concerning numerous characteristics related to pregnancies

which have terminated at or near term with the birth of a viable child accompanied by a fetus which had died before the beginning of the seventh month of gestation. In presenting the data, I have tried to proceed from the more simple facts relating to the conditions under which the twins were born to the more complex anatomic and pathologic relations which have been reported concerning them. In making statistical contrasts, I have drawn freely on the reports of normal twins and single children given by Guttmacher,<sup>147-149</sup> Greulich<sup>146</sup> and others.

In presenting my cases, I have adopted a topical method for brevity and clarity which will be applied to the analysis of the cases reported from the literature.

#### Reports of Cases

CASE 1.—This case is from the service of Dr. G. B. Byrd of Norfolk, Va. The fetus and its placenta were brought to the laboratory and the transcription of the case was furnished by Dr. Byrd. As mentioned above, the following topics have been based on this transcription. The mother was of the white race.

1. Chorial character—dichorial.
2. Age of mother—24 years.
3. Parity of mother—primipara.
4. Sex of viable twin—male.
5. Weight of viable twin—not given.
6. Time of birth of viable twin with reference to that of dead twin—immediately before.

7. Age of blighted twin in lunar months. The age was estimated from measurements of the upper arms, forearms, and legs because of the flattened and distorted condition of the fetus. Using these measurements, the age of the fetus was determined by contrasting these measurements with similar measurements of fetuses given by Seaman and Calkins.<sup>164</sup> According to the measurements, the age of the fetus was 4.9 lunar months.

8. Character of preservation of the fetus. The fetus is of the flattened or papyraceous type. The degree of flattening and distortion is shown in a photograph of this fetus as it is viewed from the convex surface (Fig. 1). It is compressed from the opposite surface. As a consequence of the compression, the head is twisted so that the right side of the face is toward the left side of the body. Similar modifications of the orientation of the head have been described by Quadrat,<sup>109</sup> Edgar,<sup>35</sup> and Male.<sup>88</sup> The features are obliterated. The arms are bent on themselves and folded under the head, the left arm on the compressed concave side, and the right lying above the shoulders on the convex surface. The hands and fingers are well preserved and have been extended in the photograph. The thorax is flattened tangentially so that most of the ventral or anterior aspect of the body is on the concave surface. A glance at the picture will show how the ribs have been flattened. The sternum is slightly arched and protected the heart from flattening. The abdominal wall is flattened against the pelvis to such a degree that there is a slight rent in the midline through which part of the flattened intestinal coils protrude. Such a condition was observed by Wilson<sup>134</sup> in a flat fetus of the fourth month. The feet are

bent on the ankles, the ankles on the lower legs, and the lower legs on the thighs. The toes are well preserved and in the photograph have been extended together with the legs.

The whole surface of the body was grayish in color, and there was no bloating or swelling which according to Thomson<sup>169</sup> is characteristic of fetuses which have been macerated for 40 or 60 days or longer. The epidermis seems to be drawn down on the underlying bones in certain regions. There is occasional shredding of the epidermis and underlying corium. A section of the body wall was examined microscopically, and it was seen that the epidermis had shrunk to a thin line which might represent the remnants of the basement membrane. The underlying subcutanea is fibrous and the remnants of cells can be observed.



Fig. 1.—Photograph of papyraceous fetus. Case 1. Arms and legs are moved out from their abnormal positions. Note the rather thick umbilical cord to left of fetus. The head is completely twisted and face is directed to the right.

Such a condition has been recorded by Thomson<sup>169</sup> in macerated connective tissues. The morphology of the layers of muscle in the wall is maintained, and under high magnification, the striations of the muscle fibers are readily visible. Charrin<sup>20</sup> is the only one who has recorded such a preservation of muscle fibers in a dead fetus of this type. This kind of preservation seems to be quite remarkable in view of the fact, that the fetus had been dead for about four months and the muscles were devoid of circulating blood. It must be concluded that the little amniotic fluid which remained following compression

must have been a good preservative. Also the nuclei along the muscle fibers are well preserved in outline, although the chromatin does not stain with hematoxylin. The lamina propria of the peritoneum is fibrous, and there is a line formerly occupied by structureless membrane in place of the mesothelium.

Brief mention may be made of the conditions observed in the viscera. In the pelvic region, the compression has so obliterated the lower end of the body, that the sex could not be determined. The intestines are flattened, but their coils can be followed in the flattened abdominal cavity. Histologically, a section of the small intestine shows the characteristic muscular laminae in which the outlines of smooth muscle cells can be seen. The mucosa has sloughed into the lumen.

The right kidney has been obliterated by the compression, but the outline of the flattened left kidney can be seen. A section of this shows the fibrous capsule, but the tubules had shrunk and no details could be observed. The glomeruli had shrunk into masses of indeterminate structure. A small piece of the ureter taken with the kidney still shows a suggestion of transitional epithelium.

The stomach was not discernible; and the liver was evident only as a mass of fibrous material attached to the yellow inferior face of the diaphragm.

The lungs are flattened and markings suggestive of the lobes can be seen. A section of the lung contains remnants of the larger bronchi, in the walls of which, can be seen well-preserved cartilage plates. The cartilage cells are well preserved in outline, and show a granular cytoplasmic content which according to Thomson<sup>169</sup> is characteristic of degenerating connective tissue cells. Good preservation of cartilage in the trachea and lungs of papyraceous fetuses has been observed by Prestat<sup>107</sup> and Rigler.<sup>112</sup> The outlines of the larger vasa in the lungs are distinct, and remnants of smooth muscle cells can be seen in their walls. The alveoli and smaller ducts, however, appear as masses of necrotic cells without stainable boundaries or nuclei. Around the lungs, the ribs stand out sharply forming the framework of the pleural cavity. The pleura is yellow and tightly drawn over the ribs and extends deeply between them. The diaphragm and pericardial membrane are well preserved, and separate their respective cavities from each other.

The heart is remarkably well preserved and nonflattened, a condition noted by Rigler<sup>112</sup> in a dead fetus of the sixth month. Prestat<sup>107</sup> reported a well preserved although flattened heart in a four-month fetus. The heart in the present fetus was not flattened because the sternum formed a protective arch above it. There is no sign of blood in the pericardial cavity. Sections of the wall of the ventricle show maintenance of morphologic organization; muscle fibers and their nuclei retain their outlines. In the muscle fibers, delicate cross striations representing the Q discs can be seen. This histologic detail has never been reported before from a fetus which has been retained in utero after death for such a long period of time.

Since the features of the fetus were obliterated by the compression and the remainder of the body was soft, not shrivelled or dried, it would appear that this fetus can be classified as fetus papyraceus, partially macerated, but not mummified. Von Brücke<sup>137</sup> has shown that histologically bones, cartilage, muscle, brain and epidermis retain their characteristics for a long time in dead fetuses, even though the nuclei fail to stain and the cell boundaries are lost; and in connective tissues wandering cells abound.

9. Condition of mother during gestation—good health.

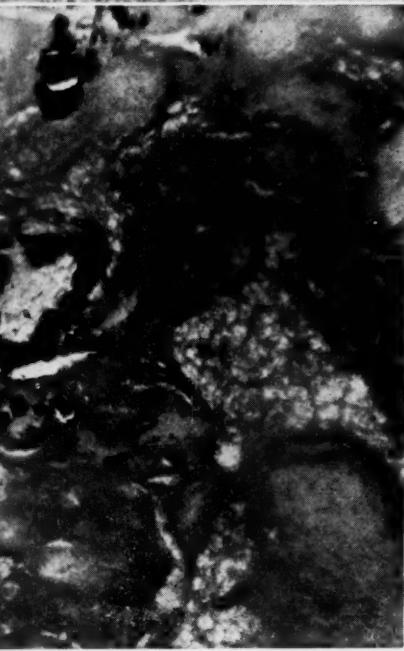
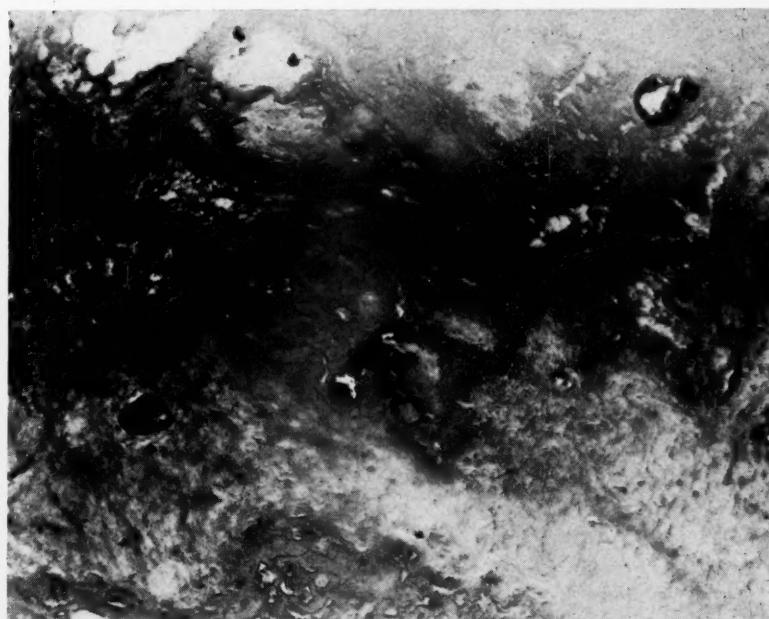
10. Characteristics of placenta. Grossly, the fetal placenta is hard. The fetal surface is covered by the closely adherent amnion, and has a glistening whitish color (Fig. 2). No traces of vasa can be seen. The maternal surface is yellow and the groups of hardened cotyledons can be observed. Dark patches occur here and there. There is no sign of any viable villi on the whole maternal surface. The placenta is concave toward the fetal surface, a condition produced apparently by the compression of the fetus. The umbilical cord is attached near one



Fig. 2.—Photograph of placentas from Case 1. Small placenta is from papyraceous fetus, larger one belongs to the viable twin.

margin about 5 mm. from the edge. It is thin, white and flat. No evidence of vasa could be seen in this piece grossly. The placenta measures 90 by 87 mm. in diameter. A section taken from the margin to the center shows it to be cone-shaped with the greatest thickness (14 mm.) in the center. From these measurements, the area of the fetal surface was estimated to be 61 square cm.; and treating it as a cone, the volume was estimated to be 29 cubic centimeters. The viable placenta measures 150 by 130 mm. in diameter and is 27 mm. thick at the center, and only slightly less in thickness at the margin. Its volume, treating it as a cylinder, was estimated to be 415 cubic centi-

A.



B.

Fig. 3.—Photomicrographs of a section of the placenta of the papyraceous fetus. Low power magnification showing remnants of villi and the masses of intervillous fibrin. The black masses are calcified areas. ( $\times 35$ .) B, High power magnification of small area of A, showing remnant of one villus; stroma light and enclosed in a ring of black calcified epithelium. Hematoxylin and eosin. ( $\times 200$ .)

meters. Hence, the volume of necrotic fetal placenta would be about 6.5 per cent of that of the viable.

The viable placenta shows no signs of gross necrosis. Its fetal surface shows the usual branching of the veins and arteries with deep bluish coloration as a background (Fig. 2). On the maternal surface, the cotyledons cannot be distinguished, and the whole surface appears as a bluish-gray mass in which a few yellow patches can be observed. It was quite compact when cut into, but was not hard and dense as is the fetal placenta. The fetal placenta was entirely distinct from the viable except at one small tangential point of contact. The fetal placenta with its attached compressed fetus enclosed in an intact amniotic membrane was delivered along with the viable placenta immediately following the birth of the viable child.

Sections of the fetal placenta show complete necrosis of the fetal elements. Traces of hyalinized villi can be seen, in between which are dense and loose masses of fibrin (Fig. 3A). There are no traces of chorionic epithelium. No traces of vasa are seen in the villi, and there is no sign of sclerosis of the vasa whose presence would be revealed by dense purple rings, which in material stained with hematoxylin is indicative of the presence of calcium. In many regions, one of which is shown in Fig. 3B, the hyaline villus is completely surrounded by a dense purplish ring which is interpreted as a deposit of insoluble calcium salts. These deposits seem to lie in the places formerly occupied by the chorionic epithelium. Sections through regions showing such deposits were incinerated according to the method of Scott<sup>166</sup> and a dense mass of ash was observed in the regions which showed purplish deposits in the preparations stained with hematoxylin and oesin. Treatment of ashed sections with hydrochloric and sulfuric acids showed the presence of gypsum crystals, which are presumed to be evidence for the presence of calcium in these deposits. This treatment was carried out because Schultz-Brauns and Schoenholz<sup>165</sup> hold that the presence of ash in heavy amounts in the regions formerly occupied by the chorionic epithelium is indicative of a pathologic process which started from the maternal surface. Following the initial necrosis of the chorionic epithelium, calcium which formerly was transmitted through the epithelium to the fetus could no longer follow this path because of lack of transportation facilities and hence, was increased in amount. On the other hand, if the fetus had died from intrinsic fetal causes, the calcium would show as rings in the walls of the fetal villous vasa and would be evidence of death from fetal arteriosclerosis. My observations led me to conclude from the above evidence that the placental condition, which is one of complete necrosis, had its inception in maternal conditions which caused necrosis of the chorionic epithelium, fibrin deposit and resulting calcium precipitation which in turn, prevented pabulum and oxygen from reaching the fetus. The sections viewed as a whole under the low power (Fig. 3A) resemble very closely the conditions shown in a section of a placenta of a blighted twin of the fourth month given by Adair.<sup>135</sup>

In contrast with the fetal placenta, sections of the placenta of the viable twin show innumerable small villous terminations extending from large villi. Some necrotic villi were observed in this placenta and calcareous deposits were seen in the cores of these villi, but not in the epithelium. This kind of senile necrosis occurs normally in term placentas and starts with degeneration of the vasa in certain of the villi. Such degeneration is accompanied by calcareous deposits as the

vasa become obliterated by endarteritic or periarteritic changes. This is a well-known phenomenon and is said to be characteristic of senile placentas.<sup>168</sup>

11. Characteristics of the umbilical cord. The umbilical cord of the fetus is 15 cm. long and extends from the umbilicus to the surface of the head on the side which has been compressed, and from there to the placenta. The region of the cord between the umbilicus and head is

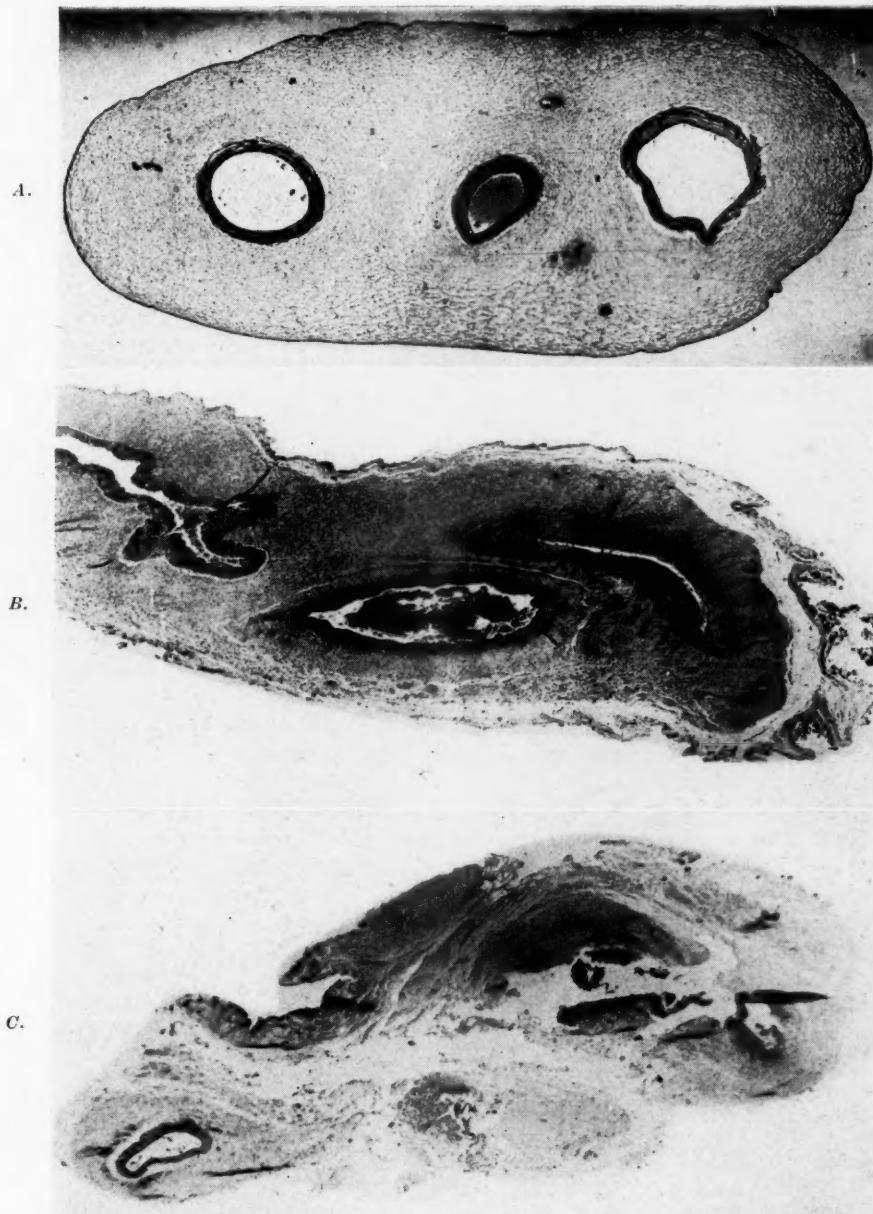


Fig. 4.—Photomicrographs of transverse sections of: A, umbilical cord of normal fetus of fourth month; B, umbilical cord of papyraceous fetus in region of least degeneration; and C, umbilical cord of same papyraceous fetus in region of greatest degeneration. Hematoxylin and eosin. ( $\times 20$ .)

flattened, but sections show it to have retained its outline with the amnion loosely attached to the underlying stroma (Fig. 4B). The stroma of mucoid connective tissue is quite fibrous, is arranged around the vasa in concentric layers, and is almost tendinous in character. In between the fibers can be seen the outlines of necrotic cells, most of which have contracted. The vasa are flattened, but have retained their outlines, and the arrangement of muscle fibers in the medias are easily recognized. There is no sign of sclerosis in these vasa. A large clot of fibrin and blood corpuscles is present in the lumen of the umbilical vein, and in one artery there is a trace of a clot. This part of the cord is 3 em. long and the diameters are 2 mm. and 7 mm., respectively. The media of the arteries averaged 1.0 mm. in thickness and that of the vein 0.4 millimeter. The lumens of the arteries are compressed, and that of the vein open with a clotted content.

The appearance of a section of that part of the umbilical cord which extends from the adhesion on the head to the placenta for a distance of 12 em. is quite degenerate as compared with the part just described. In this region, the cord is very flat and measures 4.0 by 1.5 mm. in diameter (Fig. 4C). It is incomplete in several places, and only one artery has retained its outline. The other artery and the vein have almost completely degenerated. The muscle of the media of the artery which has been preserved is shrunken and disorganized. There is no blood or clot in the lumen, or in the region of the degenerated vasa. The surrounding connective tissue is fibrous and dense, but shows less organization than the connective tissue of the other part.

For contrast with this umbilical cord, the cord of a normal fetus of 110 mm. C-R length (age about 4.3 months) was sectioned. The cord is flat and measures 6.3 by 2.7 mm. in diameter (Fig. 4A). The amnion is closely applied to the underlying stroma which is composed of the usual mucoid connective tissue cells with few fibrils irregularly arranged. This condition is in contrast with the closely packed concentric arrangement of the fibrils in the better preserved section of the cord of the papyraceous fetus. The media of the arteries average 0.5 mm. in thickness, and that of the vein 0.4 millimeter. These measurements are not significantly different from those of the same parts of the umbilical arteries and vein of the dead fetus. Hence, it appears that the better preserved part of the cord of the dead fetus has not changed much in size or arrangement of parts during the period of intrauterine retention even though the tissues are dead.

The histologic differences characteristic of the two parts of the umbilical cord of the papyraceous fetus indicate that the necrotic changes have been of longer duration in the part between the placenta and the head than in that part between the head and the umbilicus. It is concluded that this is evidence that the necrotic process started in the placenta and progressed toward the fetus, and that with the death of the fetus, the cord was compressed between the head of the fetus and the head of its viable twin, thereby slowing down the progress of necrosis in the part between the compression and the umbilicus. I think that there is no evidence for the view that the compression of the cord preceded the death of the fetus, otherwise that part of the cord nearest the fetus would show a greater degree of degeneration than that between the head and the placenta.

12. Summary. The evidence presented from a study of the placenta and umbilical cord of this fetus suggests that the fetus died because

of placental necrosis induced by some change in the maternal blood. Following death, the fetus was flattened by pressure from its twin and following this flattening a maceration process started, which although progressing to a certain degree did not completely destroy the histologic characteristics of certain organs, particularly the heart and muscle of the body wall.

Unfortunately, there is no record of the amount of fluid present in the amniotic sac of this fetus. Some fluid must have been present, since the fetus is not mummified, a condition which is said to occur when the fluid is absorbed following fetal death. The excellent preservation of histologic relation of certain of the organs and particularly of the muscle striations implies that the fluid which was present was an excellent preservative.

Another unfortunate hiatus is lack of information concerning the type of presentation of the viable twin. This information would be used in the discussion of causes of compression in the latter part of this paper.

The fetus can be called a fetus papyraceus with a degree of maceration. It shows no signs of mummification. Measurements of certain dimensions place the time of its death at 4.9 lunar months.

CASE 2.—The record of this case came from the Obstetric Service of the University of Virginia Hospital. The clinical history was given by Drs. Kight and Schneider. Dr. Kight has kindly furnished me with a transcription of the record from which the data in the following topics are taken. Neither fetus nor placenta was available. The mother was of the Negro race.

1. Chorial character—monochorial with two amnions.
2. Age of mother—18 years.
3. Parity of mother—primipara.
4. Sex of viable twin—male.
5. Weight of viable twin—2,050 grams.
6. Time of birth of viable twin with reference to that of dead fetus—immediately before. Viable twin delivered in left occipito-anterior position.
7. Age of blighted twin in lunar months—not known, but rather small.
8. Character of preservation of fetus—fetus papyraceus, flattened and macerated.
9. Condition of mother during gestation. First day of last period, November 10, 1942. Bleeding in February, 1943, for one week, otherwise health good. Such bleeding could have been coincident with time of death of the fetus as has been recorded in a number of cases of this kind.<sup>5, 9, 34, 54, 61, 70</sup> Since the fetus was not measured, this relation cannot be checked.
10. Characteristics of the placenta. Single placenta, one chorion and two amnions. Sketch on hospital record shows an area equal to about  $\frac{1}{6}$  of the placenta which was hard and fibrosed. The fetal cord was attached to this area. No record of further examination of placenta.
11. Umbilical cord—thin and flat. Cord of viable fetus, eccentric attachment; fetal cord attached near opposite margin.
12. Summary. Fetus papyraceus macerated, monochorial twin with separate amnion; placenta in region of fetal cord necrotic. Apparently, from the history, there was detachment of the placenta in the part

belonging to the fetus at the beginning of the fourth month of gestation. Otherwise, mother's health good. Premature labor beginning of seventh month with birth of viable fetus and this papyraceous fetus. Labor brought on by sudden flow of amniotic fluid from vagina while riding in auto. From the data nothing can be learned as to whether death was caused by increased activity of the other twin, or by local changes in the placenta in region of fetal attachment. The presence of the dead fetus and the necrotic part of the placenta apparently had no effect on the mother's health. Viable child presented in left occipito-anterior position.

#### Review of Literature

Analyses of reports of cases of twins in which one was born alive at or near term and the other, which died before the seventh month of pregnancy, was born at or about the same time as the viable twin.

In the following sections, the data from other authors relating to the topics listed in the reports of the two cases cited here, will be presented. Unfortunately, although I have examined most of the reported cases, there are about 30 titles to which I had reference, but which could not be obtained. I have examined the records of 148 cases. With the addition of the two cases reported here, the total number on which the following data are based is 150. However, even such a number of cases is probably mere sampling of the conditions which really occur since Guttmacher<sup>148</sup> has recorded that in 500 twin pregnancies there were 11 cases of fetus papyraceus.

As a matter of interest, but not of particular importance, I include here the references as reported by country. These are as follows: United States, 32; France, 31; England, 27; Germany, 27; Russia, 5; Hungary, 4; Italy, 4; Argentina, Belgium, Holland and Scotland, 3 each; Austria, Czechoslovakia, China, Finland, Indo-China, Ireland, India, Poland, South Africa, Sweden, Switzerland and Turkey, one each. A total of 154 references. Of these references I have examined 133, from which I have gathered data on 148 cases. In several of the more comprehensive articles, such as theses, several cases are reviewed and these frequently overlap. I have found that such a title as "fetus papyraceus" does not always refer to twins if this is the only title given, as the occurrence of this condition in triplets has been reported under this title alone. Furthermore, such a title does not mean that the unmodified fetus was born alive e.g., in 28 cases of fetus papyraceus reviewed by Lampert<sup>76</sup> only 16 were in the twin classification which I am using here.

The most comprehensive papers which I have seen have been presented by Prestat,<sup>107</sup> Dupoux,<sup>34</sup> Rigler,<sup>112</sup> Ethridge,<sup>38</sup> Cosentina,<sup>22</sup> Hélot,<sup>55</sup> Peckham-Murray,<sup>104</sup> Pujol,<sup>108</sup> Danel,<sup>27</sup> Reynès,<sup>111</sup> von Lichem,<sup>84</sup> Acconci,<sup>3</sup> Hähnel,<sup>48</sup> Schneider,<sup>117</sup> Guggisberg,<sup>47</sup> Lampert,<sup>76</sup> Aburel,<sup>2</sup> Bernhart,<sup>10</sup> and Szendi.<sup>127</sup>

In the following sections the data are gathered under the headings given in the description of my cases, and these cases are included with

those gathered from the literature. In order to prevent repetition and yet make the data understandable, the term blighted fetus as used in the following pages refers to a fetus which has died in utero before the seventh lunar month, and has been retained in utero with its viable twin until just before or after the birth of the latter. The terms monochorial and dichorionic twins are used throughout, because this diagnosis has been made from the characteristics of the placentas.

*1. Chorial Character of the Blighted Fetuses.—Total cases 141.*

Monochorionic, 48 (34 per cent).

Dichorionic, 93 (66 per cent).

These data show that in the reported cases there is a higher incidence of blighting in dichorionic than in monochorionic twins. According to Hähnel,<sup>45</sup> blighted twins are more common in monochorionic than in dichorionic twins, but no quantitative data are used to support this view. Also Peckham-Murray<sup>104</sup> states that the majority of blighted twins are those with only one placenta. The data presented here reverse these conclusions. However, examination of the data on the distribution of monochorionic and dichorionic twins in twin populations shows that the distribution of blighted twins is proportional to the distribution of monochorionic and dichorionic as reported by several investigators. The data agree closely with those presented by Kleine,<sup>153</sup> 36 per cent monochorionic; Szendi,<sup>127</sup> 34 per cent; Zangenmeister,<sup>143</sup> 30 to 35 per cent; Hoehne,<sup>143</sup> 33 per cent; McElroy,<sup>143</sup> 37.3 per cent; and with the theoretical incidence calculated by Jenkins and Gwin,<sup>150</sup> about 36 per cent. The percentage of monochorionic twinning is greater than the percentages given by Goecke,<sup>143</sup> 16 per cent; Orel,<sup>143</sup> 21 to 26 per cent; Von Verschner,<sup>143</sup> 23 to 25 per cent; Olshauser,<sup>143</sup> 25 per cent; Ahfeld,<sup>143</sup> 16 per cent; Guttmacher,<sup>147</sup> 25.7 per cent; and Greulich,<sup>146</sup> 18.17 per cent. It is less than that given by Komai and Fukuoka<sup>154</sup> (56 per cent). In view of these distributions of monochorionic twins in a number of twin populations, it is concluded that one of dichorionic twins is not more often blighted than is one of monochorionic twins, but the difference in incidence is due to the distributions of the two types of twinning in twin populations.

There were only three cases in which the monochorionic twins were mono-amniotic.<sup>7, 11, 61</sup>

*2. Age of Mother in Relation to Blighted Twins. Eighty-four cases.*

TABLE I. AGE OF MOTHER AND CHORIAL CHARACTER OF BLIGHTED TWINS, 84 CASES

		AGE OF MOTHER IN YEARS						
		UNDER 20	20 TO 25	25 TO 30	30 TO 35	35 TO 40	OVER 40	TOTALS
Number	Monochorionic	5	8	10	6	3	0	32
	Dichorionic	0	9	13	19	4	7	52
Per cent	Monochorionic	15.6	25.0	31.3	18.7	9.4	0	100
	Dichorionic	0	17.4	25.0	36.4	7.7	13.5	100

Table I shows that when the ages of the mothers in which one of the twins is blighted are compared with regard to chorionic character, there is a trend in the direction of youth on the part of mothers of monochorial twins. Up to the age of 30 years, there is a greater percentage of blighting when the twins are monochorial; and the reverse when they are dichorionic. These distributions were tested to see whether they were due to the distributions of the twins of each type in the general population at these ages, or whether the blighting was related to age alone. For purposes of these contrasts, two tables have been made from the data available in the literature.

TABLE II. PERCENTAGE INCIDENCE OF BLIGHITED MONOCHORIAL TWINS AND AGE OF MOTHERS CONTRASTED WITH DISTRIBUTIONS OF MONOCHORIAL TWINS ON MOTHERS' AGE IN NORMAL MONOCHORIAL TWIN POPULATIONS

SOURCE OF DATA	AGE OF MOTHERS IN YEARS					
	UNDER 20	20 TO 25	25 TO 30	30 TO 35	35 TO 40	OVER 40
Blighted (Present)	15.6	25.0	31.2	18.7	9.4	0
Normal (Guttmacher <sup>147</sup> )	18.5	32.8	21.0	15.1	7.6	5.0
Normal (Greulich <sup>146</sup> )	19.0	31.0	22.0	20.0	12.0	4.0

In Table II the data from Guttmacher<sup>147</sup> and Greulich<sup>146</sup> indicate that the distribution of the blighted twins in relation to mother's age is probably proportional to the incidences of monochorial twins in mothers of these age groups, and that this distribution is not so much related to the age of the mother as it is to the incidence of monochorial twins in mothers of these age groups. The greatest degree of blighting occurs in those ages where the monochorial twins are most numerous. Thus, the trend to youth in mothers of blighted twins shown in Table I, is the result of the tendency of the younger mothers to have more monochorial twins than older mothers. The chi-square test of these data supports this view, as there is no significant deviation from expectation except in the older group where the incidence of blighting is less than expected.

TABLE III. PERCENTAGE INCIDENCE OF BLIGHITED DICHORIAL TWINS AND AGE OF MOTHERS CONTRASTED WITH DISTRIBUTIONS OF DICHORIAL TWINS ON MOTHERS' AGE IN NORMAL DICHORIAL TWIN POPULATIONS

SOURCE OF DATA	AGE OF MOTHERS IN YEARS					
	UNDER 20	20 TO 25	25 TO 30	30 TO 35	35 TO 40	OVER 40
Blighted (Present)	0	17.4	25.0	36.5	7.7	13.5
Normal (Guttmacher <sup>147</sup> )	9.3	22.3	25.4	22.1	19.2	1.7
Normal (Greulich <sup>146</sup> )	6.0	22.0	26.0	26.0	18.0	4.0

Table III shows that blighting of one twin in dichorionic pregnancies occurs less often than would be expected in mothers under 20 years of age, and from 35 to 40 years; and it is proportional to the distribution of normal twins in mothers from 20 to 30 years of age; while it is greater than expectation in the 30 to 35-year group and in those over

40 years of age. The dichorionic group shows more variation from expectation than the monochorionic group, hence, the chi-square test has been applied to this table. In this contrast, the data of Guttmacher and Greulich have been averaged, and the average incidences have been contrasted with the incidences given in the present data.

TABLE IV. CHI-SQUARE TEST FOR DISTRIBUTION OF BLIGHTING IN DICHORIAL TWINS AND AGE OF MOTHERS

SOURCE OF DATA	AGE OF MOTHER IN YEARS					
	UNDER 20	20 TO 25	25 TO 30	30 TO 35	35 TO 40	OVER 40
Blighted (Present)	0	17.4	25.0	36.5	7.7	13.5
Normal (Guttmacher and Greulich)	7.5	22.0	25.0	24.0	19.0	3.0
Chi-square	7.5	0.96	0.0	8.5	8.75	36.6

Since the total chi-square value in Table IV is 62.31, and the number of classes (*n*) is 5, the probability that in the whole group the blighting is not proportional to the distribution of the twins in all classes is very significant, less than 0.01.<sup>140</sup> Examination of the table, however, with reference to the several classes, shows that the large total chi-square value is due to variation from expectancy in four of the six classes. In the under 20-year class, blighting is significantly less than would be expected. It is proportional to the population in the 20- to 25- and 25- to 30-year classes; is significantly greater in the 30- to 35-year class and notably less in the 35- to 40-year class. Finally, it is significantly greater than expectation in mothers, 40 years of age or older. Hence, it is concluded that in dichorionic gestations, there is more chance of one twin being blighted if the mothers are older than 40 years, and less chance if they are younger.

When the results given here are used in contrasting blighting in dichorionic and monochorionic twins in relation to the age of the mother, it is seen that there is less relation between blighting and age of mother in monochorionic than in dichorionic twins. In the dichorionic group, there are two classes of mothers in which blighting is greater than expected, while in the monochorionic group, there is none. Thus, the age of the mother seems to be definitely concerned with survival of both members of a twin pregnancy only when the twins are dichorionic and the mother is either from 30 to 35 years, or over 40 years of age.

### 3 A. Blighting in Relation to Parity of Mother and Chorionic Character of Pregnancy.

The data in this section were obtained from the records given in 101 cases. In Table V the numerical and percentage incidences of the monochorionic and dichorionic pregnancies are listed. The data so listed were tested for significance with reference to the incidences of monochorionic and dichorionic twins and parity of mothers in normal twins as given by Guttmacher.<sup>147</sup> In the latter tables (Tables VI and VII), the chi-square test for agreement with expectations has been applied.

TABLE V. INCIDENCE OF BLIGHTED TWINS AND PARITY OF MOTHER, 101 CASES

CHORIAL CHARACTER	PARITY OF MOTHER						TOTALS
	1	2	3	4	5 AND OVER		
Number	Monochorial	16	4	6	2	8	36
	Dichorinal	13	14	5	4	29	65
Per cent	Monochorial	44.5	11.1	16.6	5.6	22.2	100
	Dichorinal	20.0	21.6	7.7	6.2	44.5	100

When the values in the different para groups shown in Table V are contrasted, it will be seen that there seem to be relatively more blighted monochorinal twins in primiparas and in the para 3 class than in these same classes in the dichorinal group. Whereas more dichorinal than monochorinal twins seem to have been blighted in the para 2 and para 5 classes. These differences, however, have no significance unless they are tested against the proportions of monochorial and dichorinal twins in twin populations at different degrees of parity. Hence, tests have been made by the chi-square method using the data of Guttmacher<sup>147</sup> on the incidences of monochorial and dichorinal normal twins in relation to parity. These data are presented in the following tables (Tables VI and VII).

TABLE VI. CHI-SQUARE TEST OF PERCENTAGE INCIDENCE OF BLIGHTED MONOCHORIAL TWINS AGAINST NORMAL MONOCHORIAL TWINS AND PARITY OF MOTHER

SOURCE OF DATA	PARITY OF MOTHER						Total chi-square, 15.81
	1	2	3	4	5 AND OVER		
Blighted (Present)	44.5	11.1	16.6	5.6	22.2		
Normal (Guttmacher <sup>147</sup> )	31.9	17.6	11.8	16.0	22.7		
Chi-square	5.0	2.4	1.9	6.5	0.01		

When the total chi-square is 15.81 and n equals 4, the probability that the incidence of blighting differs from expected proportions is significant ( $P = 0.01$ ).<sup>140</sup> However, examination of Table VI shows that in the separate para classes, the primiparas have more blighting than should be expected, and there is less blighting than was expected in the para 4 class. Except for these differences, the distribution shows that blighting is proportional to the incidence of normal monochorial twins in the several para classes. Thus, in only the primiparas is there greater blighting than should be expected if the incidence of blighted twins depended only on the distributions of the normal twins in the several para classes. Such a distribution suggests that there is some factor or factors which make monochorial twins susceptible to blighting when the mother is a primipara.

Since in Table VII the total chi-square is 11.8 and n is 4, the distributions of the blighted dichorinal twins depart significantly from expectations. However, examination of the table shows that this deviation is caused entirely by the incidence of blighting in the para 2 group.

TABLE VII. CHI-SQUARE TEST OF PERCENTAGE INCIDENCE OF BLIGHTED DICHORIAL TWINS AGAINST NORMAL DICHORIAL TWINS AND PARITY OF MOTHER

SOURCE OF DATA	PARITY OF MOTHER					Total chi-square, 11.8
	1	2	3	4	5 AND OVER	
Blighted (Present)	20.0	21.6	7.7	6.2	44.5	
Normal (Guttmacher <sup>147</sup> )	20.2	11.8	12.6	10.6	44.8	
Chi-square	0.002	8.0	1.9	1.9	0.002	

There is significantly more blighting in this class than was expected. Hence, it is concluded that except for the para 2 class, the parity of the mother does not influence the blighting of dichorial twins and that blighting is proportional to the distribution of the normal dichorial twins in the several classes of parity.

When the data obtained from Tables VI and VII are contrasted and reference is made to Table V, it is seen that the high incidence of blighting in monochorial twins of primiparous mothers is significantly greater than that in primiparas with dichorial twins. Also, the greater incidence of blighting in the dichorial twins of para 2 mothers is significantly greater than in monochorial twins of the same class of mothers. In the other classes of mothers in both monochorial and dichorial pregnancies, the incidences of blighting are proportional to the population of twins of these classes, or even less than expected proportions.

The most important conclusion from these comparative data is the fact that blighting of one twin may occur more often than should be expected in monochorial pregnancies of primiparous mothers.

### 3 B. Death of One Twin in Twin Pregnancies and Parity of the Mother contrasted With Death of Fetuses in Single Pregnancies and Parity of Mother.

In this section an attempt has been made to test the expectancy of death of one twin in twin pregnancies in relation to parity by contrasting these data with those for the deaths of fetuses in relation to parity in single pregnancies. The data used for the single fetuses are those of Grier<sup>145</sup> obtained from an analysis of the incidence of fetal death in relation to parity in 4,668 consecutive deliveries. There were 225 fetal deaths. The data on the blighted fetuses are the combined figures of incidences of monoehorial and dichorial twins on parity given in Table V.

TABLE VIII. CHI-SQUARE TEST OF BLIGHTING OF ONE TWIN IN TWIN PREGNANCIES AND PARITY AS CONTRASTED WITH FETAL AND PARITY IN SINGLE PREGNANCIES.  
DATA GIVEN TO NEAREST 1.0 PER CENT.

GROUP	PARITY OF MOTHER				
	1	2	3	4	5 AND OVER
Blighted twins	29	18	11	6	37
Single fetuses	47	26	13	5	7
Chi-square	1.1	2.4	0.3	0.01	129.0

Table VIII shows that by the use of the chi-square method, no significant differences are revealed between the incidences of death of one of twins and of single fetuses in any degrees of parity except in the para 5 and over class of mothers. In this class, the percentage of death of one of twins is significantly greater than that for single births. But before making a final conclusion, the data of Guttmacher<sup>147</sup> on the incidence of twin births in this class were consulted, and from these data it appears that the apparently great difference is, in large part, caused by the relatively greater number of twins born to mothers of this class as contrasted with the mothers in the other classes. Whereas in single pregnancies the greatest number of births is in primiparas, in twins it is in the five or over pregnancy class, and so population differences must be borne in mind when making such contrasts as above. Even if this population difference exists between the different parous classes, it still seems possible to conclude that the relative incidence of blighting of one fetus in twin pregnancies is significantly greater than the incidence of death of single fetuses in single pregnancies, when in both cases the mothers are in the fifth or higher degree of parity.

*4. Sex of the Viable Twin of Twin Pregnancies in which one is Blighted.*

In 142 cases in which the chorial characters of the twins were given, the sex of the viable twin was recorded in only 71 cases. The distribution is as follows: Monochorionic: male, 19 (39.6 per cent); female, 10 (20.8 per cent); sex not given, 19 (39.6 per cent). Dichorionic: male, 25 (27.8 per cent); female 22, (18.9 per cent); sex not given, 48 (53.3 per cent).

These data show that in this group of blighted twins, the percentage of blighting is greater in those sets in which the surviving twin is male in both monochorionic and dichorionic pregnancies. These data tend to support the view of Aburel<sup>2</sup> that female monochorionic twins survive more often than male, and of Pringle (cited by Aburel), that mortality is less among female pairs of twins. However, because of the high percentage of cases in which no sex was recorded, the evidence for this view may not be statistically significant.

The sex ratio in U.S. Vital Statistics for 1937,<sup>172</sup> for one twin born alive is: viable twin males, 642 (53.5 per cent); females, 554 (46.5 per cent). The data in the present paper grouping all twins together show twin pregnancies in which males survive to be 44 cases (62.0 per cent); and females, 27 (38 per cent), a distribution which is not significantly different from the U.S. Vital Statistics. Hence these data support the view expressed above that twins, of which one is male, are more susceptible to blighting than those in which one is female.

*5. Weights of Surviving Viable Twins in Contrast With Each Other; With the Weights of Twins in Which Both Survive; and With the Weights of Single Births.*

A. Weights of viable survivors of monochorial and dichorial twins in which one member of the pair has died before the seventh month of pregnancy. Data given as averages with standard errors (v) of these averages.

1. Monochorial (20 cases); average weight,  $3,550 \pm 180$  grams.
2. Dichorial (31 cases); average weight,  $3,100 \pm 150$  grams.

TABLE IX. CONTRAST BY THE CHI-SQUARE METHOD OF VIABLE TWIN SURVIVORS OF BLIGHTED TWIN PREGNANCIES BY WEIGHT WITH WEIGHTS OF TWINS IN WHICH BOTH SURVIVED (DATA ON THE LATTER FROM POTTER AND CRUNDEN<sup>161</sup>)

CLASS	VIABLE SURVIVORS PERCENTAGE	BOTH TWINS VIABLE PERCENTAGE	CHI-SQUARE
500 to 1,000 grams	0	5.2	5.2
1,000 to 2,500 grams	15.7	43.6	17.9
2,500 to 6,000 grams	84.3	51.2	21.4

Contrast of the above shows that monochorial twin survivors average  $450 \pm 740$  grams heavier than dichorial. This difference is not statistically significant.

B. Weights of the same groups classified by sex.

1. Monochorial males (9 cases); average weight,  $3,720 \pm 320$  grams.
2. Monochorial females (5 cases); average weight,  $3,200 \pm 360$  grams.
3. Dichorial males (11 cases); average weight,  $3,080 \pm 190$  grams.
4. Dichorial females (9 cases); average weight,  $3,040 \pm 190$  grams.

Contrasting the above data by the standard error method for check on significant differences shows that the monochorial males average  $520 \pm 485$  grams heavier than monochorial females. This difference is not statistically significant.<sup>140</sup>

Monochorial males average  $640 \pm 375$  grams heavier than dichorial males. This difference is not statistically significant.

Monochorial females average  $160 \pm 400$  grams heavier than dichorial females, but this difference in weight is not statistically significant.

In brief, the above data show that there are no statistically significant differences between the weights of viable twin survivors of monochorial and dichorial pregnancies; nor is there any difference between the weights of males and females.

C. Weights of viable twin survivors of twin pregnancies in which one twin has died before the seventh month, compared with the weights of viable twins in which both survive.

1. Average weight of viable twins, both surviving, 2,391 grams (333 pairs, Potter and Crunden<sup>161</sup>).
2. Average weight of viable survivor of blighted twin pregnancies (51 cases), 3,280 grams.

These data show that the viable survivors of blighted twin pregnancies are on the average 889 grams heavier than twins in which both are viable.

In order to see how the weights of these two groups compared in distribution, they were classified into the groups listed by Potter and Crunden.<sup>161</sup>

Table IX shows that there are fewer viable survivors of blighted twin pregnancies in the lower weight classes, and more in the upper weight class, than there are in these classes in twin pregnancies when both twins survive. In all classes when analyzed by the chi-square method, the departure from expectation is statistically significant. Hence, it is concluded from these data that the surviving twin of a twin pregnancy in which one twin is blighted is more likely to be heavier than either one of twins where both survive. According to Statz as cited by Newman,<sup>158</sup> increase in weight of the surviving twin is probably due to the appropriation of the nutritive material by this twin at the expense of its companion. This is particularly true of monochorial twins.

D. Contrast of the weights of viable twin survivors with weights of single births in preivable, premature and normal birth weight classes. The data for the weights of single births are from Potter and Crunden,<sup>161</sup> and are contrasted with the weights of viable twin survivors given in the previous sections.

TABLE X. CONTRASTS BY THE CHI-SQUARE METHOD OF WEIGHTS OF Viable TWIN SURVIVORS WITH THOSE OF SINGLE BIRTHS

CLASS	SINGLE BIRTHS PERCENTAGE	Viable SURVIVORS PERCENTAGE	CHI-SQUARE
Previable, 400 to 1,000 grams	0.52	0	0.52
Premature, 1,000 to 2,500 grams	5.8	15.7	17.0
Mature, 2,500 to 6,000 grams	93.6	84.3	0.92
Total			18.42

The total chi-square value of 18.42 in Table X indicates that the deviation from expectancy is statistically significant. Practically all of this high chi-square value is caused by the greater number of surviving twins in the premature class than would be expected if the distribution was proportional to the distribution of the weights of single births. Hence, it is concluded that surviving twins of blighted twin pregnancies have a higher incidence of premature birth than do children of single pregnancies. According to Guttmacher<sup>149</sup> in 573 twin pregnancies,  $\frac{3}{8}$  of the number were in the premature class. This fact combined with the data given in this section and in section C, suggests that there is a greater tendency for the surviving twin of twin pregnancies in which one has died before the seventh month to approach

the average birth weights of single births in the mature class, than do twins in which both survive.

#### 6. Time of Birth of Viable Twin in Relation to That of Dead Twin.

The data in this section were obtained from records of 46 monochorial and 84 dichorial pregnancies. These data are summarized in Table XI.

TABLE XI. CONTRAST OF TIME OF BIRTH OF MONOCHORIAL AND DICHORIAL VIABLE TWINS AND BLIGHTED FETUSES. THE NUMBERS REFER TO THE TWIN BORN FIRST

TWIN	NUMBER		PERCENTAGE	
	MONOCHORIAL	DICHORIAL	MONOCHORIAL	DICHORIAL
Viable Fetus	34 12	72 12	74 26	86 14

The data in Table XI seem to show that dichorial viable twins were born before the blighted fetus more often than were monochorial viable twins, but statistical analysis showed that this difference was not statistically significant.

A further analysis of the time at which the viable twin or dead fetus was born showed the following results in the monochorial group: when the viable twin was born first, it was born within 1 to 5 hours before the dead fetus in 33 cases; in only one case was there a delay in birth of the fetus and in this case, it followed the viable birth by three days.<sup>66</sup> When the fetus was born first, it immediately preceded the viable twin in 11 cases and in only one case was there much time between births and this was only 19 hours.<sup>54</sup>

In the dichorial group however, there was wider variation between the times of birth. In 64 cases, birth of the viable twin immediately preceded the birth of the dead fetus; in one case it was 12 hours sooner<sup>97</sup>; in one case 48 hours sooner<sup>131</sup>; in 4 cases, 3 days sooner<sup>16, 21, 119, 129</sup>; in one case 3 weeks,<sup>33</sup> and in another case 7 weeks elapsed between viable birth and birth of the dead fetus.<sup>64</sup> In two cases the dead fetus was born on the head of the viable twin.<sup>84a\*, 125</sup>

These analyses indicate that in the monochorial pregnancies, there was less tendency for either fetus or viable twin to be retained in the uterus for an appreciable time after the birth of its twin, than there was in dichorial pregnancies. Such a variation is related to the independence of the placentas in the dichorial pregnancies.

#### 7. Age of Blighted Twins in Lunar Months in Monochorial and Dichorial Pregnancies.

In the earlier reported cases, the age of the blighted fetus was estimated from its appearance, and no accurate measurements of length were made. As early as 1834, Franeke<sup>41</sup> gave measurements and fol-

\*The small letter accompanying a reference number indicates that this is one of several cases described in this particular reference.

lowing that time, the age was estimated from measurements in most reported cases. Finally, with the development of the x-ray, age was determined by judging the degree of ossification. As a result of the early reports, the idea grew that blighting occurred most often from the third to the fifth month of pregnancy in twin pregnancies where one was born viable. According to von Lichem,<sup>84</sup> such a conclusion is stated in von Winckel's Handbook. Hähnel<sup>48</sup> in his review of a number of cases, also comes to this conclusion. Peckham-Murray<sup>104</sup> in a review of the literature suggests this opinion and cites as references Settegast, Kieselhausen, and Hohl. Settegast reported a review of 19 cases in which 6 fetuses had died at the third month; 8 at the fourth; 3 at the fifth and 2 at the sixth month. Of 29 cases collected by Kieselhausen, there were 11 fetuses of the fourth month. Hohl reviewed 23 cases of which 13 were fetuses of the fourth month. Unfortunately, I did not have access to these articles. However, these cases probably overlapped each other, and are without doubt included in the cases which I have gathered. The blighted fetuses reported in the literature examined are listed according to chorial character and age in lunar months in Table XII. In those cases where measurements were given, the age in lunar months was calculated by the use of the formula of Seaman and Calkins.<sup>164</sup>

TABLE XII. AGE OF BLIGHTED TWINS IN LUNAR MONTHS IN MONOCHORIAL AND DICHORIAL PREGNANCIES. DATA FROM 131 CASES (PERCENTAGE, NEAREST 1.0 PER CENT.)

CHORIAL CHARACTER		AGE OF BLIGHTED FETUS IN LUNAR MONTHS						TOTALS
		1	2	3	4	5	6	
Number	Monochorial	0	6	13	15	9	3	46
	Dichorial	1	9	26	30	15	4	85
Per cent	Monochorial	0	13	28	33	20	7	
	Dichorial	1	11	31	35	18	5	

Examination of Table XII shows that fetal death occurs to the same relative degree in the same months in both monochorial and dichorial pregnancies. Furthermore, the peak of the highest mortality in both groups is from the third to the fifth months. The greatest number of deaths occurs before the sixth month. As stated above, such a distribution has been suggested by other investigators, but the earlier data have been scattered and not of sufficient magnitude to adequately support this view.

#### 8. Character of Preservation of the Dead Fetus and Its Relation to the Time of Death in Utero.

The records of cases examined indicate that the blighted fetus may be physically affected in a number of ways. The variety of change may be briefly classified as follows with regard also to chorial character and incidence of the several types of modification:

## I. Nonflattened.

1. Well preserved; monochorial, 3 (6.6 per cent); dichorial, 7 (8.5 per cent).
2. Macerated; monochorial, 2 (4.4 per cent); dichorial, 8 (9.9 per cent).
3. Dried or mummified; monochorial, 2 (4.4 per cent); dichorial, 6 (7.4 per cent).

## II. Flattened.

1. Well preserved; monochorial, 23 (51.1 per cent); dichorial, 44 (54.3 per cent).
2. Macerated; monochorial, 4 (8.8 per cent); dichorial, 3 (3.6 per cent).
3. Dried or mummified; monochorial, 11 (24.6 per cent); dichorial, 13 (16.1 per cent).

In the above group, none of the flattened fetuses was putrid, while one of the nonflattened macerated monochorial fetuses was putrid,<sup>50</sup> and two of the dichorial were so described.<sup>29, 72</sup>

In addition to the fetuses classified here by chorial character, there were 6 cases in which no chorial character was recorded. Five of these were flattened, of which 3 were well preserved,<sup>30, 115, 118</sup> one was macerated,<sup>114</sup> and one was mummified.<sup>65</sup>

The above brief summary demonstrates that in both monochorial and dichorial pregnancies, the greatest percentage of blighted fetuses which died in utero before the seventh month were flattened (monochorial, 84.5 per cent; dichorial, 74.0 per cent). Those which are flattened and well preserved include also those concerning which no particular remarks were made beyond the statement that they were flat. It is possible that some of these, if they had been examined in detail, would have shown some degree of maceration. The data indicate that chorial character has little to do with the type of modification as there are no significant differences in the distribution of the fetuses in the several categories. Before pursuing the possible factors involved in the modifications, a table showing the relation between the types of modification and the time of death in utero will be given (Table XIII).

Starting with the nonflattened well-preserved class of fetuses, the data in Table XIII demonstrate that this unmodified class is quite widely distributed in the dichorial group, and limited to older fetuses in the monochorial group. Maceration in the nonflattened classes has about the same incidence in both monochorial and dichorial groups, and is confined to fetuses of the fourth month or older. The same distribution is true of nonflattened mummified fetuses.

The flattened well-preserved fetuses form the largest classes in the third through the fifth month in the monochorial group, and in the

TABLE XIII. PHYSICAL CHARACTERISTICS OF BLIGHTED FETUSES OF TWIN PREGNANCIES IN WHICH ONE TWIN SURVIVED. THE LUNAR MONTH OF DEATH OF FETUS, THE TYPE OF MODIFICATION, THE CHORIAL CHARACTER (M IS MONOCHORIAL; D, DICHORIAL) AND THE NUMBER OF FETUSES ARE GIVEN IN SECTION A. IN SECTION B, THE PERCENTAGE INCIDENCE IS GIVEN.

## SECTION A. NUMERICAL DISTRIBUTION

MONTH	NONFLATTENED						FLATTENED					
	WELL PRESERVED		MACERATED		DRY		WELL PRESERVED		MACERATED		DRY	
	M	D	M	D	M	D	M	D	M	D	M	D
1	0	1	0	0	0	0	0	0	0	0	0	0
2	0	3	0	0	0	0	3	6	0	0	3	3
3	0	1	0	0	0	0	8	19	2	1	2	3
4	2	1	1	3	1	3	6	13	2	0	3	5
5	0	1	1	3	1	3	5	4	0	1	2	0
6	1	0	0	2	0	0	1	2	0	1	1	2
Totals	3	7	2	8	2	6	23	44	4	3	11	13

## SECTION B. PERCENTAGE DISTRIBUTION

MONTH	NONFLATTENED						FLATTENED					
	WELL PRESERVED		MACERATED		DRY		WELL PRESERVED		MACERATED		DRY	
	M	D	M	D	M	D	M	D	M	D	M	D
1	0	1.2	0	0	0	0	0	0	0	0	0	0
2	0	3.7	0	0	0	0	6.8	7.4	0	0	6.8	3.7
3	0	1.2	0	0	0	0	17.7	23.4	4.4	1.2	4.4	3.7
4	4.4	1.2	2.2	3.7	2.2	3.7	13.3	16.0	4.4	0	6.8	6.3
5	0	1.2	2.2	3.7	2.2	3.7	11.1	5.0	0	1.2	4.4	0
6	2.2	0	0	2.5	0	0	2.2	2.5	0	1.2	2.2	2.5
Totals	6.6	8.5	4.4	9.9	4.4	7.4	51.1	54.3	8.8	3.6	24.6	16.2

third and fourth months in the dichorionic group, although they are distributed in both groups from the second through the sixth month. These are fetuses classically designated as fetus papyraceus or compressus, terms which as far as I can ascertain, were first applied to the flattened fetus by Settegast (see Peckham-Murray<sup>104</sup>) in about 1872. According to Verrier,<sup>171</sup> Paul Dubois coined the term "un petit bonhomme du pain d'épice" or "a little gingerbread man," which was used by the French to designate this type of fetus. Barnes and Barnes<sup>136</sup> have called this type of fetus, fetus foliaceus.

Flattening and maceration seem to have a higher incidence in the monochorionic than in the dichorionic group, and also seem to have an earlier trend than when the fetus is nonflattened. Flattening with mummification has a rather wide distribution, but in no month is the incidence higher than flattening alone, so that there must be a specific factor which acts to produce the change by which the fetus becomes dried. It is not the fate of most flattened fetuses. Also mummification seems to have a higher incidence in the monochorionic than in the dichorionic group.

The physical aspects of blighted fetus as listed here have been known for a long time, particularly that flattening of blighted fetuses occurs most often in the early months of pregnancy. It is referred to by

Guillemeau,<sup>see 30</sup> Dewees,<sup>139</sup> Cruveilhier,<sup>see 117</sup> Playfair,<sup>158</sup> Caseaux and Tarnier,<sup>see 136</sup> Barnes and Barnes<sup>136</sup> and others. Quantitative data such as have been presented here, have not been gathered to support this view. Another view which is current and is attributed to Settegast,<sup>see 104</sup> is that if one fetus dies from the second through the sixth month in a twin pregnancy while its twin survives, the dead twin goes through a hardening or mummification process, but rarely becomes a lithopedion because of the presence of the second fetus. According to von Lichem,<sup>84</sup> mummification is the typical fate of a fetus which dies in utero from the third to the fifth month of gestation, if its partner survives. The present data do not support this view, as can be seen from Table XIII. The great majority of the fetuses are flattened, but only about a third of those that are flattened become mummified, even though the flattening may occur early in pregnancy. Maceration is generally recognized as occurring in the later months of pregnancy, but these data show that it may occur at any time during pregnancy after the second month.

It is now generally accepted that flattening is not the primary cause of death in all cases, but following death of the fetus, it is flattened by its companion, because the amniotic fluid is absorbed and no more is produced either from the placenta or from the fetus itself. With an idea of testing this view, the cases were examined for reference to the relation between the amniotic fluid and the type of preservation of the fetus. In 25 cases from the monochorial group, some comment was made upon this relation. A brief résumé of these remarks is presented in the following paragraphs.

Two of these cases dealt with a mono-amniotic condition. In one of these, the fluid was normal in amount, and the fetus was well preserved<sup>7</sup>; in the other, the fluid was thick and creamy with a disagreeable odor, and the fetus was flattened and mummified.<sup>61</sup> In three cases where the amnions were separate, fluid was present. In one of these, the fetus was macerated and foul<sup>50</sup>; in the second, the fetus was flattened and well preserved<sup>4</sup>; and in the third, the fluid was coffee-colored and the fetus was flattened.<sup>42</sup> There was one unusual case in which the amnion was well preserved, and a well-preserved fetus was present embedded in a dark brown jelly which contained amniotic bands which compressed the umbilical cord.<sup>23</sup>

In eighteen cases, the amnions were separate and there was no fluid in the amniotic cavity. The effects of this condition on the enclosed fetus were not the same in all cases. Two were flat and macerated<sup>49</sup> as in Case 2 of this report; four were flat and well preserved;<sup>9, 104, 131, 53</sup> nine were flat and mummified;<sup>14, 23, 34, 55, 69, 70, 107, 109, 130</sup> one had amniotic bands, and the fetus was flat;<sup>98</sup> in one, the amnion was fibrous, desquamated, edematous and the fetus was flat and mummified;<sup>3</sup> and in one, the amnion was decomposed, but the fetus was flat and mummified.<sup>103</sup>

In brief, these data offer support for the idea that in monochorionic pregnancies where one twin is dead, lack of amniotic fluid is followed by flattening and mummification of the dead fetus in only about  $\frac{1}{3}$  of the cases. The whole data seem to be against the view that there is a lack of fluid in all cases of fetus papyraceus which become mummified. There is a fairly wide variety of modification, which can occur under conditions in which the amniotic fluid is lacking.

In the dichorionic group, there were 42 cases in which some remarks were made concerning the amnion and its fluid. There was only one case in which amniotic fluid was present in normal amount and character, and in this case, the fetus was well preserved.<sup>80</sup> In one case, there was a normal amount of fluid, but it was creamy and the fetus was flat and mummified;<sup>93</sup> and in another, the fluid was green and the fetus was well preserved (Marye, cited by De Marmion<sup>29</sup>).

In five cases, a little amniotic fluid of unmodified character was present, and in three of these, the fetuses were well preserved;<sup>30, 57, 67</sup> in one, the fetus was shrivelled, but not flat;<sup>64</sup> and in another, the fetus was flat.<sup>88</sup> In two cases, reddish-brown fluid was present in the fetal amniotic cavity, and the fetus in one of these was macerated,<sup>13</sup> and in the other flat and macerated.<sup>112</sup> Aburel<sup>2</sup> presented 6 cases (3 monochorionic and 3 dichorionic), five of which had died later than the seventh month, and hence, are not included in this paper, but the cases are of interest because in four of them, the amniotic fluid of the viable twin was chocolate-colored. He thinks that the color has been given to the fluid of the viable by that of the dead twin, and it may be used as a clinical sign of the presence of a dead twin, if such has not been suspected before. In two cases, the fluid was malodorous, and in one of these, the fetus was well preserved;<sup>124</sup> and in the other, it was flat and macerated.<sup>78</sup>

There were 17 cases in which there was no amniotic fluid, and the fetuses were flattened, but not mummified or macerated.<sup>17, 19, 23a, 32, 35, 41, 43, 77, 81, 83, 86, 102, 106a and b, 111a, 113, 117, 119</sup> There was one case without fluid in which the fetus was nonflattened, but macerated.<sup>47</sup> In 9 cases without fluid, the fetus was flat and mummified.<sup>3, 10, 22, 23b, 25, 91, 108, 113, 127</sup> In two cases without fluid, but in a very early stage of development, no fetuses were found.<sup>67a and b</sup> In one case, the amnion was deliquescent and putrid, and the fetus was putrid.<sup>32</sup>

In four of the above cases, the authors stated that hydramnios was present in the amnion of the viable twin.<sup>17, 23a, 35, 47</sup> In four cases, the authors said that the marks of compression by the head of the viable twin could readily be observed on the compressed fetus;<sup>12, 86, 108, 132</sup> and in one case,<sup>109</sup> the viable fetus showed the impression of the fetus on its left frontal bone at birth.

This brief review shows that in twelve dichorionic pregnancies with viable and blighted twins in which amniotic fluid was present in the

amnion of the blighted twin, only two of these were flattened. While in 29 cases with no amniotic fluid, 26 of the fetuses were flattened, and 9 of these mummified as well. These data certainly indicate that flattening is concomitant with lack of fluid, but they also deny the proposition that lack of fluid always leads to mummification. The evidence from both monochorial and dichorial pregnancies agrees in this respect.

These data from both monochorial and dichorial pregnancies suggest that with diminution of fluid within the amnion of the blighted fetus, the viable twin as it enlarged, compressed the dead twin by the hydrostatic pressure of its fluid-filled amnion between this amnion and the uterine wall. If the dead twin happens to lie in the region where the viable fetus makes direct contact with the amnion wall, such a dead twin will be flattened more than one which may lie in the region of the placenta on the ventral side, or near the legs of the viable twin. The variations in shape of the blighted fetuses which have been recorded, may I think, be attributed to their position with reference to the head of the dead fetus, rather than to the general pressure of its amniotic fluid.

It is therefore, conceivable that the position of twins in the uterus has something to do with the modification or molding of the body of the dead twin by its mate. Most of the investigators who have examined the characteristics of the flattened fetuses carefully have concluded that most of the pressure has been due to the head of the viable fetus. The data which have been gathered concerning the relative positions of normal twins as they present themselves at birth, and also the data on the presentations of viable twins accompanied by a dead twin may be of aid in explaining the distributions of the modifications of the dead twins which have been observed. It is an open question whether presentation, orientation, and intrauterine orientation are identical in single births, because the single fetus is unhampered in its movements. But in twin pregnancies, it would seem that the presentation would reveal the actual position the twins had in utero, because of the limitations of movement imposed on them after they have reached a certain size, or at about the time the placenta is being formed during the third month. On this assumption, it seems logical to assume that if twins are oriented in the uterus in such a manner that their heads lie adjacent to each other and one of them dies, it is more likely to be compressed than if it were in some other position. The only position in which the dead twin would not be in danger of flattening, is that in which the fetuses are in vertex-breech orientation with reference to each other. In normal twins at birth, such vertex-breech orientation has been recorded in 40 per cent of 536 cases (Ramsbotham<sup>110</sup>); 34.3 per cent of 1,688 cases (Werth, cited by DeLee<sup>138</sup>); 31.7 per cent of 1,138 cases (Kleinwachter and Reuss, cited by Barnes and Barnes<sup>136</sup>); and 22.8 per cent of 514 cases (Kuder, cited by Stander<sup>167</sup>). Thus, on

the average from these data, the position would be favorable for non-flattening in about 32.2 per cent of all twin pregnancies, or in 25 per cent of twin pregnancies in which there is vertex presentations of one of the twins. Data gathered from 77 cases in which one twin had died before the seventh month showed that the viable twin presented cephalically in 92 per cent of the cases. Now, if the proportion of vertex-breech positions were originally the same as in cases where both twins were viable, then 25 per cent of the total vertex presenting cases should have been those in which the vertex-breech orientation was the original position. If this relation as assumed herein is favorable for nonflattening, we should expect that 25 per cent of these 71 cases (92 per cent of the total) should be accompanied by nonflattened twins. Actually 17 of these cases, or 24 per cent showed this condition, one viable and one nonflattened twin. Thus, the data support the original suggestion quite well. On the other hand, the conclusion can be made that in any other position than the above, the fetus is practically always flattened. This conclusion is not only supported by the afore-mentioned data, but by the fact that in six cases in which the viable twin presented in a position other than vertex, the dead twin was flattened.

It is generally held that if a blighted twin dies before the end of the second month, it may completely disappear. Several such cases have been presented by King.<sup>67</sup> Also, as twins grow in size and one of them dies and is not compressed, the same factors of autolysis which operate to completely destroy younger embryos, will produce maceration without complete disintegration because of the limited time in which autolysis may act. The larger the body, the less chance for complete autolysis so that in the later stages of pregnancy, fetuses which have escaped flattening are, as a rule, macerated.

If the amniotic fluid ceases to be produced and is absorbed and the dead fetus does not lie in the region of the head of its viable twin, then an unflattened, shrivelled, mummified fetus may be produced such as is found in single pregnancies. This is an unusual condition as it is recorded in only 2 monochorial<sup>54, 69</sup> and 6 dichorial pregnancies.<sup>26, 28, 36, 64</sup>

Putrefaction, gangrenous character, foulness, etc., are rather unusual in the cases reviewed. Lack of putrefaction is probably caused by the presence of the intact chorion in both monochorial and dichorial pregnancies. If the chorion is broken, then the amnion is exposed to the uterine environment, it is soon destroyed, inflammation occurs and the mass becomes foul and pus accumulates around this foreign body. The cases in which the dead fetus is foul smelling have this common characteristic. Another view which has been suggested by Bianca holds, that if a fetus dies and its chorion is nearer to the air than that of its fellow, it will become infected from organisms which enter through the cervix (cited from Depaul<sup>32</sup>).

One exception to the general views expressed herein, concerns the fate of the fetus when its twin has hydramnios. Four cases have been noted in the above review. It is conceivable that in such a condition, the formation of the fluid in one amnion at a greater rate than in the other would force the lesser filled amnion with its twin against the uterine wall, and actually kill it by excessive hydrostatic pressure. Szendi<sup>127</sup> states that hydramnios occurred in 8 per cent of 244 twin pregnancies and was present more often in monochorial, while the incidence in single pregnancies is 0.5 to 1.0 per cent according to Hinselman (see Szendi<sup>127</sup>).

Mummification of the fetus is a puzzling sequence of death. It is a fact that the body becomes dry and hard, but it is difficult to understand how this can take place in the presence of amniotic fluid as reported in several cases.<sup>26, 28, 36, 64, 69, 79</sup> The only answer which may be given is based on the supposition that the fluid present is secondarily occupying the space around the dead fetus following actual primary disappearance of the amniotic fluid with the subsequent drying of the fetus. This fluid could have come from the amnion of the other twin, or may be fluid which has exuded around the dead fetus from the uterine wall. As pointed out in my description of the fetus in Case 1, the fluid must be a very good preservative when present, because of the manner in which it has maintained the form and characteristics of the minute muscle striation in the heart and the larger ones in the body wall. There is apparently a battle between the enzymes of destruction inherent in the dead body of the retained fetus and the surrounding fluid. The effect of the latter is to fix the tissues in such a condition that as little harm as possible may be done to the viable fetus and the mother. If this effect is fully accomplished, the fetus shrinks and becomes mummified, but if it is only partially effective, certain parts become macerated or completely digested, and the varying degrees of dissolution which have been recorded occur.

In general, it may be briefly concluded that modification of the physical characteristics of a blighted fetus depends on the time at which it dies, its position in the uterus with reference to its viable companion, the amount and character of the amniotic fluid both in its own and in its companion's amnion; and finally whether the chorion is ruptured.

#### 9. *Histories of Mothers During Pregnancy.*

The clinical data in 139 cases were examined to see what conditions were present in the mother during pregnancy. From the records available, the mothers were classified as: (a) in good health; (b) experiencing acute illness at the time of death of the fetus; (c) having been subjected to external violence or trauma at a time coinciding with the death of the fetus; (d) chronic illness during pregnancy; (e) emotional disturbance coinciding with time of death of fetus; and (f) no history.

TABLE XIV. CLASSIFICATION OF MOTHERS AS TO HEALTH, ACUTE ILLNESS, ETC.; SEX OF Viable TWIN AND CHORIAL CHARACTER OF THE PREGNANCY. M, IS MONOCHORIAL; D, DICHORIAL. TOTAL CASES: MONOCHORIAL, 48; DICHORIAL, 91.

A. NUMBER OF INDIVIDUALS IN EACH CLASS

SEX OF Viable TWIN	GOOD HEALTH		ACUTE ILLNESS		TRAUMA		CHRONIC ILLNESS		EMOTIONAL DISTURBANCE		NO HISTORY	
	M	D	M	D	M	D	M	D	M	D	M	D
Male	11	13	4	3	0	1	3	5	0	1	1	2
Female	7	6	0	4	2	1	1	4	0	1	0	1
Sex not given	1	23	1	4	1	2	1	6	0	0	15	13
Totals	19	42	5	11	3	4	5	15	0	2	16	16

B. PERCENTAGE OF INDIVIDUALS IN EACH CLASS

Male	23.0	14.4	8.3	3.3	0	1.1	6.2	5.5	0	1.1	2.1	2.2
Female	14.6	6.6	0	4.4	4.2	1.1	2.1	4.4	0	1.1	0	1.1
Sex not given	2.1	25.4	2.1	4.4	2.1	2.2	2.1	6.6	0	0	31.2	14.4
Totals	39.7	46.4	10.4	12.1	6.3	4.4	10.4	16.5	0	2.2	33.3	17.7

From the data in Table XIV, it is evident in both monochorial and dichorial pregnancies where a viable twin is accompanied by a dead fetus, the greatest percentage of mothers showed no subjective symptoms of ill-health. Furthermore, it is probable that in those cases where no history was given, the gestation was so uneventful that it was not even commented upon. Hence, the group of healthy mothers may be even greater than the limited data show. Further examination of the table indicates that the proportion of mothers in good health when the viable fetuses are male is about twice as great as when they are female, in both monochorial and dichorial pregnancies. Such a distribution implies that maleness in either of twins does not necessarily produce more harmful effects on the mother than when they are females. It is possible that in the group classified as in good health, there are mothers who may have systemic disease or organic disease which although not appearing at the time of pregnancy, may affect the health of the fetuses. Such comment is suggested by the recent paper of Miller et al.<sup>156</sup> as a result of their study on the deaths of fetuses of mothers who became diabetic after the pregnancy, which had ended in the death of a child.

In the group of cases included under acute illness which coincided with death of one fetus, physical symptoms such as hemorrhage, escape of amniotic fluid, acute illness, sudden intrauterine pain, etc., were referred to. These symptoms were suggested to be evidence of intrauterine conditions, which in single pregnancies would result in miscarriage or expulsion of the dead fetus and its membranes. Hence, such symptoms are regarded as objective evidence of the time of fetal death. In this group aside from the acute attack, the remainder of the pregnancy was uneventful. In this group there is no significant difference related to chorial character, although in the monochorial group, the cases in which the viable twin is male, are significantly more numer-

ous (8.3 per cent) than in those in which it is female (0 per cent). Hence, the tendency to have acute illness which could be called a missed abortion seems to be more likely to happen in monochorial pregnancies when the viable twin is male.

Trauma to the mother which was coincident with the estimated time of death of the fetus occurred in a small number of cases, monochorial (6.3 per cent), dichorial (4.4 per cent), and undoubtedly caused the death of the fetus. But these cases, however, demand further attention to see whether or not the trauma was merely incidental to a congenital abnormality of the fetus or its membranes. Such an examination of the data is made in the next section.

Chronic illness of the mother throughout pregnancy was present in 10.4 per cent of monochorial pregnancies and 16.5 per cent of the dichorial. Such illness may have been the cause of the death of the fetus, since it was present throughout gestation and did not start at a date coincident with fetal death. Even though there seems to be a higher incidence of illness in the dichorial group, the relative difference between the two groups is not statistically significant. In view of the conclusions of Fournier and Klein,<sup>141</sup> from a study of the death of one twin (13 cases) in 210 sets of twins, that syphilis caused the death of most of the fetuses, it might be pointed out here that in the whole group of cases reported here, there were only two cases in which syphilis was reported.<sup>42, 44</sup> Therefore, it is concluded that since there were only 2 mothers who had syphilis out of 107 cases in which the histories are known, syphilis is not a major factor in the production of blighted twins.

The number of mothers who had an emotional disturbance which they claimed was coincident with the time of death of the fetus is small, and the death of the fetus may not have any relation to this condition. Such a possibility is examined later.

On the whole, the data would seem to imply that the presence of a dead fetus together with its dead fetal membranes has little effect on the mother, since the highest percentage of mothers showed no ill effects, and in those cases where an acute illness occurred coincident with fetal death, the pregnancy continued uneventfully. Therefore, the toxemias of pregnancy, as a general rule, cannot be laid to the presence of degenerating fetuses and fetal membranes. A more extended examination of this question will be taken up in the next section which is concerned with the characteristics of the fetal membranes.

#### 10. *Condition of the Mother During Pregnancy and the Characteristics of the Placenta of the Blighted Fetus.*

The case reports were examined to see what relation there might be between the condition of the mother during pregnancy, and the characteristics of the placenta of the blighted fetus. Much of the data on the placental characteristics were obtained from the older literature,

and are from descriptions based upon the physical characteristics as viewed grossly. The conclusions as to the nature of these characteristics were guided by the prevailing opinion of the nosological meaning of such characteristics. With the introduction of the microscope, a more accurate diagnosis of the morphology of the placenta could be made, and such diagnoses are incorporated in the more recent reports.

The classification of the placentas as given in Table XV is so arranged because of the recurring reference to these larger characteristics. The classes are as follows: (1) placenta in good state of preservation, no gross areas of necrosis; (2) placentas partly preserved, in which there was some evidence of change, but the placental region belonging to the blighted fetus was not completely involved; (3) placentas showing fatty degeneration in which diagnosis has been made largely on color and the physical character of the maternal surface. The placentas looked like fat and felt like fat. In only one case in the older literature, such a conclusion was reached by microscopic examination, which revealed fat droplets in material from the fresh placenta (Wilson<sup>134</sup>). (4) Placentas showing hard atrophy including those cases in which the placenta was described as hard, dense, tough, dried, shrivelled, fibrinous, and sclerotic. In placentas from monochorial pregnancies, such change was limited to the vicinity of attachment of the blighted fetus as in Case 2 of this paper. In some of these cases, the histology of such placentas has been described following microscopic study, but these are very few, and will be referred to in the discussion following the table. Monochorial placentas with vascular anastomoses are not included as such in this table, but will be commented on further in this section.

In addition to the above conditions which have been classified, there were several placentas which were gangrenous or foul, or in which there was extravasation of blood on the fetal surface.

TABLE XV. STATE OF HEALTH OF MOTHER DURING PREGNANCY AND CHARACTER OF PLACENTA. M, MONOCHORIAL; D, DICHORIAL. TOTAL CASES: MONOCHORIAL 15; DICHORIAL, 46. PERCENTAGES GIVEN IN PARENTHESES

Condition	GOOD PRESERVATION		PARTLY PRESERVED		FATTY DEGENERATION		HARD ATROPHY	
	M	D	M	D	M	D	M	D
	No. %	No. %	No. %	No. %	No. %	No. %	No. %	No. %
Healthy	3 (20)	1 (2)	1 (7)	-	-	7 (14)	5 (33)	12 (24)
Acute illness	-	-	-	1 (2)	1 (7)	3 (6)	1 (7)	3 (6)
Chronic illness	-	-	1 (7)	1 (2)	-	3 (6)	2 (13)	5 (10)
Trauma	-	-	-	-	-	1 (2)	-	3 (6)
No history	1 (7)	-	-	-	-	1 (2)	-	5 (10)
Totals	4 (27)	1 (2)	2 (14)	2 (4)	1 (7)	15 (30)	8 (53)	28 (56)

From an examination of Table XV, it can be seen that relatively, the healthy mother in those classes where the history is given, is the

only group in which good or normal preservation has been reported as characteristic of the placenta of the dead fetus. Better preservation is present in monochorial placentas than in dichorial, possibly because the localized necrosis in the former may be compensated by the growth of the normal part of the placenta to such a degree, that grossly, the necrotic region may not be recognized. The same condition could prevail in partially preserved placentas.

"Fatty degeneration" of the placenta seems to be more common in the placentas of dead dichorial twins than in those of monochorial, and has been reported in all of the classes of mothers. Thus, this type of degeneration has no relation to a specific clinical condition of the mother. The term "fatty degeneration" has been used to describe a condition in which the maternal surface of the placenta when viewed grossly, shows yellowish matted masses in the regions where in the normal placenta the cotyledons can be seen. These characteristics have been given in cases where microscopic examination was not made. According to Frankl (cited by Adair<sup>135</sup>), infarcts of placentas resulting from villous degeneration have a yellow color when viewed in the fresh condition. Sarway and Frank (cited from Adair<sup>135</sup>) also define these infarcts as having such a color. Robin and Barns (cited from Adair<sup>135</sup>) seem to be the only ones who suggest that fatty degeneration is coincidental with placental necrosis. From the modern point of view, the cases reported as "fatty degeneration" should be classified as evidences of infarction, which in dichorial placentas include the whole placenta. These represent an early stage in the history of infarction, which is the result of villous necrosis and accumulation of masses of fibrin between the villi (Adair<sup>135</sup> and Montgomery<sup>94</sup>). These are found normally in senile placentas.<sup>168</sup> Now, if they represent the first stage in the obliteration of the villi which culminates in hard atrophy or dense hard white masses, it would seem that these conditions should be found in those cases in which the fetuses are older than those whose placentas are characterized by hard atrophy. The cases in which hard atrophy were reported are more numerous than those with "fatty degeneration" and it would seem that the great majority of the placentas reach full atrophy during the course of pregnancy. The percentage of hard atrophy is higher in the dichorial group. It is found more often in monochorial than is "fatty degeneration," a difference which may be accounted for by the greater ease with which this condition may be noted in gross examination. If these two types of degeneration are related in point of time, they should show some difference in distribution as regards the time at which the fetus died.

Analysis of the data from 15 cases of "fatty degeneration" and 24 cases of hard atrophy from dichorial pregnancies in which the age of the dead fetus was given, showed no significant difference in distribution of the two types of degeneration with reference to time. In the

fatty group, the time range was from 2.5 through 6.5 months; and in the hard atrophy group, from 2.5 to 6 months. From these distributions, it is concluded that it is not possible to judge from the character of the placenta how long it was in the uterus. Apparently, there is rapid and slow degeneration, and the whole process may not be consummated during the sojourn of the dead placenta in the uterus.

Young<sup>173</sup> in presenting arguments for an explanation of toxemias of pregnancy states that if the fetus dies and the circulation in the placenta stops and infarction develops, no toxemia will be manifest in the mother. On the other hand, if the placenta becomes partially necrotic, and the fetus remains alive and circulation is maintained in the placenta, toxemia is likely to develop. In all of the cases reviewed here, a viable twin is present together with a dead twin fetus with its necrotic placenta. Yet only a small proportion of individuals containing such twins showed any signs of ill-health even though they contain a viable fetus and a large mass of necrotic material, which according to Young, should induce a high incidence of toxemia. It may be that Young would insist that the circulations of viable and dead placentas are separate, and therefore, the conditions necessary for effect on the mother are not present. Such could be the case in dichorionic twins with separate placentas, but in dichorionic twins with fused placentas and in monochorionic twins in which the necrotic part of the placenta belonging to the dead fetus is intimately associated with that of the viable, the maternal blood circulating in the placenta would certainly be exposed to the conditions suggested by Young as incident to maternal toxemia. In order to test this idea quantitatively, an attempt was made to see how much necrotic placenta could be retained in those cases where the mother was not affected. Unfortunately, in the records of all of the cases examined there were only nine, including Case 1 of this paper, in which measurements of the placenta were given. The data on the volumes of the dead placentas (dichorionic pregnancies) showed that these had a range of volume equivalent to from 4.0 to 50.0 per cent of the volume of the viable placenta. Hence, it is concluded that it is possible for the mother to have a large volume of necrotic placenta in the uterus, which even in the presence of a viable twin, produced no demonstrable clinical symptoms as far as can be judged from the reports of the conditions of the mothers in these cases.

Many papers have been written concerning the conclusions as to the cause of necrosis of the placenta as judged from microscopic observations. Adair<sup>135</sup> has presented an extensive review of the older views on this subject, and other views have been presented recently by McNalley,<sup>156</sup> Montgomery,<sup>94</sup> Goodall,<sup>144</sup> and Kearn.<sup>152</sup> The problem raised is whether the necrosis of the placenta is caused by primary fetal death, or by primary maternal effective agents. This question has been

attacked by Schultz-Brauns and Schoenholz<sup>165</sup> using the incineration method. According to these investigators, necrosis of the placenta from maternal causes results in a deposition of calcium in the epithelium of the villi; while if necrosis originated with the fetal vascular system, the walls of the vasa of the villi show calcium deposits. They hold that although staining with hematoxylin shows calcium when present in massive amounts, it cannot be adequately demonstrated if present in small amounts. The incineration method does this by removing all of the organic matter and leaving only the metallic ash. The presence of calcium is detected by testing with reagents which reveal the calcium present as gypsum crystals. The study of the placenta of Case 1 of this paper, is the only recent study in which this method has been used. As pointed out in the section on the description of the placenta, the conclusion was reached that the necrosis of the placenta probably had a maternal origin. As controls for this study, the chorionic epithelium and placentas of 51 apparently normal embryos and fetuses from our collection were sectioned and the sections incinerated. In none of these was there any great deposition of calcium in the epithelium, and all of them had only the normal distribution of fibrin in the intervillous spaces, and the epithelium of the villi was normal for the particular stage investigated.

In addition to the conditions of necrosis which accounted for most of the cases wherein a description of the placenta was given, there was one placenta from a monochorial pregnancy in which that part of the placenta belonging to the dead fetus was foul; but in this case, the amnion was ruptured, and no doubt, the condition was the result of bacterial invasion.

Vascular anastomoses in the placenta were, of course, limited to monochorial pregnancies. In the records of 48 monochorial cases examined, there were only 6 reports in which vascular anastomoses were mentioned.<sup>3, 37, 84, 109, 127, 128</sup> This is quite a small number when it is considered that Sehatz (cited by Newman<sup>158</sup>) who has studied this condition extensively, concludes that it is one of the primary causes of death of one twin in monochorial pregnancies. Vermelin (cited by Szendi<sup>127</sup>) also supports this view, but Szendi after making an examination of twenty placentas in which vascular anastomosis was present and both twins were viable, considers that it is only a minor cause of death. The present data support Szendi's view. For the manner in which death is brought about in cases of vascular anastomoses, the reader is referred to the excellent discussion in Newman.<sup>158</sup>

The description of the dichorial placentas were examined to see if there were any significant differences in the histories of the mothers in regard to the fused or separate condition of these placentas. These data are summarized in Table XVI.

TABLE XVI. DISTRIBUTIONS OF FUSED AND SEPARATE PLACENTAS WITH REFERENCE TO THE CONDITION OF THE MOTHER DURING PREGNANCY—91 CASES OF DICHORIAL PREGNANCY

TYPE OF PLACENTA	CONDITION OF MOTHER					TOTALS	
	HEALTHY	ACUTE ILLNESS	CHRONIC ILLNESS	TRAUMA	NO HISTORY		
Number	Fused	20	8	8	1	4	41
	Separate	22	8	8	5	7	50
Percent-age	Fused	50	19	19	2	10	
	Separate	44	16	16	10	14	

Examination of Table XVI shows that there are no significant differences between the incidences of fused and separate placentas and the condition of the mother, except possibly in the accident group. In this group, it might be possible to conclude that injuries are more harmful and the placenta more liable to injury from trauma if the placentas are separate. If acute illness coinciding with the death of the fetus is produced by an intrauterine condition affecting the placenta, it is apparent that this can affect the fused just as much as the separate placentas, and that fusion of placentas does not offer protection against uterine injury of a subjective nature.

The data were examined to see how frequently miscarriage in previous pregnancies occurred. Out of 150 cases, a history of miscarriage in previous pregnancies was recorded in 7 cases or 4.7 per cent of the total. Although this is a small number in contrast with the whole group, it is, nevertheless, suggestive that in women who have had miscarriages and are undergoing twin gestation, the possibility that one of the twins may be blighted should be borne in mind.

A history of twinning in previous pregnancies was found in 8 cases out of the 150 or in 5.3 per cent of the cases. This is a rather high incidence of a history of twinning in such a small population and would seem to indicate that along with the twinning tendency, there may be changes in the uterus which do not always favor the survival of both twins in those individuals who have already had twins in previous pregnancies.

There were two cases of placenta previa. In one case, the placenta of the viable twin was in this position,<sup>57</sup> and in the other, the placenta of the dead fetus was abnormally placed.<sup>73</sup> In the latter case, the viable child and fetus were removed by cesarean section.

#### 11. Characteristics of the Umbilical Cord.

A. Monochorial pregnancies. According to Potter and Adair,<sup>160</sup> cord complications or anomalies were mentioned as a possible cause of stillbirth in single children in 17.5 per cent of all children who died from known complications in a population of 6,750 stillbirths. The records of the cases discussed in the previous sections were reviewed to find

out, if possible, how many of the dead fetuses of monochorial pregnancies could have had fatal cord complications. Of 21 cases in which the characteristics of the cord were given, only ten showed anatomic evidence of a condition which could have produced death in the fetus by cutting it off from the placenta. These conditions are as follows: cord knotted;<sup>5</sup> cord looped around the neck and anastomoses of fetal arteries and veins with those of viable in placenta;<sup>37</sup> velamentous insertion of the cord with thrombus in the umbilical vein between amnion and placenta;<sup>15</sup> only one artery and vein in both the umbilical cord of the fetus and that of its viable mate with anastomosis of circulations in placenta;<sup>127</sup> velamentous insertion, anastomoses between viable and dead twin circulations;<sup>3, 84</sup> velamentous insertion;<sup>63</sup> cord cut by amniotic bands.<sup>45, 98</sup> In one case, the cord was very short and twisted, a condition which could conceivably prevent proper circulation between fetus and placenta.<sup>7</sup> Of the other conditions of the cord, all could have been secondary to necrosis of the placenta or the fetus, as has been discussed in Case 1. Thus, of 21 cases in which conditions of the cord have been noted, 47 per cent showed complications or anomalies which could have caused the death of the fetus. This proportion of death from cord complications is significantly greater than death from the same kinds of complication in fetuses of single pregnancies. Only three cases of mono-amniotic twins were recorded in the monochorial group. In one of these as noted above, the cord was extremely short;<sup>7</sup> in the second case, the mother had been exposed to terrific trauma coincident with death of the fetus;<sup>61</sup> and in the third, the cord was marginally attached.<sup>11</sup> Thus, in none of these cases was there knotting or intertwining of the cords such as Quigley<sup>162</sup> has reported as a frequent fatal complication of older mono-amniotic twins.

B. Dichorionic pregnancies. In this group, no case has been found in which the vasa of the blighted twin were related to those of the viable. This of course, is because of the independent origin and development of the two chorionic circulations. Certain characteristics of the cord have been described in 31 cases of dichorionic twins, of which one has died before the beginning of the seventh month. Of these, 8 or 26 per cent had modifications of such degree that they could have been the cause of death of the fetus. The conditions described are as follows: (a) wrapped around parts of the body;<sup>75, 86, 88</sup> (b) compressed by the knees;<sup>41</sup> (c) only one vein and one artery present;<sup>117</sup> (d) stenosis of the umbilical vein;<sup>22</sup> (e) velamentous insertion;<sup>83</sup> (f) separated at umbilicus;<sup>21</sup> and (g) very short.<sup>10</sup> In the remainder of the cases, the cord was described as normal, atrophied, thin, flat, soft, hard, etc. All of these modifications could have been secondary to necrosis of the placenta as I have shown from a study of the cord of the fetus in Case 1 of this paper. Thus, the percentage of death of fetuses in dichorionic pregnancies from cord complications is greater than in single pregnancies, but less than in monochorial pregnancies.

In comparing the monochorial and dichorial pregnancies with regard to umbilical cord complications, it is of interest to note that there were five cases of velamentous insertion in the monochorial group, and only one in the dichorial group. According to Williams,<sup>168</sup> velamentous insertion occurred in 1.25 per cent of single pregnancies; and he cites Lefevre as having found an incidence of 0.84 per cent velamentous insertions in 15,891 cases of single placentas, and Miranoff as recording an incidence of 0.57 per cent in single placentas, but of 5.0 per cent in twin placentas. The present data would seem to supplement this view as regards twins, with the corollary, that velamentous insertion is more common in monochorial than in dichorial twins. In view of the origin of this condition as a result of shifting of the placental blood plexus, it is not surprising that it would be found more often in placentas of twins derived from a single ovum than in those derived from two independent ova.

### Summary

An attempt has been made to bring together as much information as was available in the literature concerning the maternal history and fetal relations in twin pregnancies in which one twin was born viable at or near term together with a blighted twin which had died in utero prior to the beginning of the seventh month of pregnancy. Two cases of this kind available to the author have been included and used as a basis for an analysis of the cases reported in the literature. One hundred and fifty cases have been used for the presentation of the comparative data. Also data on normal twinning, placentation etc., have been used as supplementary material.

Some of the more important results may be briefly summarized as follows: Blighting occurs in the same proportion in monochorial as in dichorial pregnancies; it occurs more often in primiparas when the pregnancy is monochorial. There is greater degree of blighting in dichorial pregnancies when the mother is 30 to 35 years of age or over forty years of age, than at any other time either in dichorial or monochorial pregnancies. There is no sex bias in blighting. Surviving twins are heavier than either of twins of viable twin pregnancies.

The viable twin is usually the first born, and is usually presented in the cephalic position.

The greatest incidence of blighting is from the third through the fifth month; flattening of the blighted twin is its usual fate, but it may remain well preserved, nonflattened, macerated or mummified. Amniotic fluid is usually lacking in amniotic cavities of fetuses which are flattened and mummified, but fluid of unknown origin may be present around a mummy which is hard. The position of the fetus in the uterus prior to death is suggested as being related to the kind of physical modification which it undergoes. Hydramnios may be a factor in flattening, but it is not the only factor.

An uneventful course of pregnancy is the rule rather than the exception. Syphilis occurred in only two reported cases.

Detailed histologic study has revealed the remarkable preservation of muscle striations in the heart and voluntary muscle of a 4.9 month fetus *papyraceus*, which was retained in the uterus with its viable twin until term.

Varying degrees of preservation were reported for the placentas. They were practically always necrotic either in part (monochorial), or in whole (dichorionic). The incineration method was applied to sections of the placenta of the 4.9 month fetus (Case 1), and it was revealed that calcium deposits were confined to the original sites of the chorionic epithelium, a condition which Schultze-Brauns and Schoenholz hold as evidence for the primary necrosis of the placenta as of maternal origin.

Vascular anastomoses in the placentas of monochorial twins have been recorded as occurring in only a few cases of blighted twins, so that it is considered not to be a great factor in the death of one of monochorial twins.

Cord complications which could lead to death of the fetus have been recorded in relatively more cases than is characteristic of single pregnancies. The characteristics of the umbilical cord in Case 1 of this paper, show that necrosis progressed from the placenta toward the fetus.

Uniformity of recording the characteristics of blighted fetuses is suggested as a valuable aid in extending our knowledge of this condition, since we cannot set up experiments in animals which will parallel the conditions peculiar to human plural gestation.

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## THE CONDUCT OF THE THIRD STAGE OF LABOR

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**I**N 1939 Leff<sup>1</sup> stated after an experience of 7,500 personally conducted labors that the third stage of labor, "consists of two phases; the first, the separation of the placenta; and, the second, the delivery of the placenta. The separation of the placenta is a normal physiologic process which is accomplished entirely by the contractions of the uterus and the reduction in its size as soon as the baby is born, while the second phase, the delivery of the placenta is, as a rule, not accomplished by the natural forces, but must have the assistance of the obstetrician. . . . The delivery of the placenta has to be aided artificially." Previously, Warnekros<sup>2</sup> in 1918, and Weibel,<sup>3</sup> independently in 1919, demonstrated by x-ray studies that the placenta separated within five minutes after the delivery of the baby, and that one or two postpartum contractions sufficed to accomplish this separation. They showed also that there is little evidence of the retroplacental hemorrhage or hematoma still illustrated by imaginative drawings in textbooks. Weibel<sup>3</sup> found in some cases where it took only one to one and a half minutes to take the first x-ray picture after the delivery of the baby, that the placenta was already separated by the time the dye was injected. Recently, Danforth, Graham, and Ivy<sup>4</sup> by sagittal sections in monkeys concluded that separation of the placenta is almost complete by the end of the second stage of labor in these animals and, by analogy, felt that this was probably true of human beings. Titus<sup>5</sup> from a sagittal section study of a woman who died at the end of the second stage concluded that the placenta in this patient was sheared off by the uterine contractions without any retroplacental bleeding. Greenhill,<sup>10</sup> Davis,<sup>6</sup> Boynton,<sup>8</sup> and others have come to the same conclusions.

Leff<sup>1</sup> stated that "the generally considered signs of separation of the placenta" (i.e., descent of the cord, rising up and change in shape of the uterus, and bleeding) "are of no value. There are *no* signs. The placenta separates immediately." As regards the effect of narcotics or anesthetics on the mechanism of separation, the majority of observers feel that these slow the mechanism somewhat. In my experience, the separation is occasionally not complete because of the effect of anesthetics or large amounts of analgesics. However, intravenous ergotrate compensates for this deleterious effect of analgesics and anesthetics. Thus Davis and Boynton<sup>6</sup> in 1,000 patients found that the placenta not only separated, but was actually delivered in less than three minutes when intravenous ergotrate was given with the delivery of the shoulders.

In common with all who have used ergonovine intravenously, they feel that its use promotes and hastens this normal, natural, quick mechanism. The signs mentioned above are those of expulsion of the placenta into the lower uterine segment or vagina, and not signs of separation of the placenta from the wall of the uterus. The signs vary greatly in the time of their appearance and, indeed, may never appear. The last mentioned viz. bleeding, I consider pathologic because it indicates partial retention of blood in the uterus behind an *already separated* placenta which is not being expelled from the uterus. Conditions are proper for the delivery of the placenta within one minute after the intravenous injection of ergotrate, and in the unanesthetized woman within one or two minutes after the delivery of the baby even without the use of this drug. From our knowledge of the physiology of this stage, I believe that we should terminate it promptly. Such is not the common practice and teaching, however. This is due possibly to a misunderstanding of the mechanism of the third stage. Thus Rushmore<sup>7</sup> in 1937, asked in the Massachusetts State Board Examinations, "Give in detail your treatment of a patient in whom there appears no sign of separation of the placenta twenty minutes after the birth of the child." He says, "It is hardly necessary to note that this is a perfectly normal case as described although there is a possibility of complication arising." In view of the opinions already expressed, I believe that he is confusing separation of the placenta with its expulsion into the lower segment. The case is not normal if the placenta has not separated at the end of twenty minutes. He calls this a "simple question" and "easy answer." I consider it neither. Of 250 candidates, 182 failed to pass on this question. The answers were varied in the extreme. Failure to terminate the third stage of labor quickly, results in the retention of the placenta many times. Jellet<sup>8</sup> states that such a retention "is one of the most common complications of labor . . . and in some cases the placenta would be retained in utero indefinitely." Moreover, this retention either with or without a later hemorrhage not infrequently requires its manual removal. Thus at the Rotunda previous to 1929 in 45,000 deliveries with a cautious policy of noninterference with this stage of labor, and in women not usually narcotized nor anesthetized, the incidence was one in 75 cases. More recent statistics, those of Schwartz and Richards,<sup>9</sup> reveal retention once in every 120 deliveries. Moreover, more women die in this stage of labor than in any other, due it is true generally, to pathology of pregnancy, or of the first or second stages of labor, but due also sometimes to an inherent risk in this stage even in normal women with normal deliveries of their babies. I believe that a change of viewpoint as to the mechanism of the third stage of labor and a resulting change in management of this stage will lessen this inherent risk.

At the present time, most obstetricians recommend simple placing of the hands on the uterus, and when the uterus rises into the abdomen

and the cord slips farther out of the vagina, to then express the placenta from the cervix or vagina by a downward and backward push without squeezing the uterus as is done in true Credé technique. I repeat, however, that the signs mentioned in the various texts are those not of separation of the placenta, but of the presence of the placenta in the lower segment of the uterus, the cervical canal, or the vagina, and one may wait a long, long time for these phenomena to appear with the ever-present danger of the uterus filling up with blood or, on the contrary, contracting so firmly about the placenta as to imprison it. A brief consideration of the leading texts will show that the distinction between separation of the placenta and expulsion of the placenta from the uterus, a distinction fundamental in the proper treatment of the third stage of labor, is not clearly stated. Thus Beek<sup>10</sup> teaches to wait until the fundus rises and the cord protrudes or slips down and there is a gush of blood, all of which he says, "show conclusively that separation of the placenta is complete." But the separation is complete long before this. He does not allow expression of the placenta until these signs appear. After an hour, he consents to a "true Credé." He believes it unwise to leave the placenta within the uterine cavity for more than three or four hours, since its separation may at any time be accompanied by a profuse hemorrhage. This is in complete disagreement with Schumann<sup>11</sup> who allows the placenta to stay within the uterus for twenty-four hours. It seems to me, moreover, that if it is unwise to leave the placenta in for three hours, it is unwise to have it in the uterus at the end of four hours. Stander<sup>12</sup> waits at least an hour before manual removal, unless bleeding occurs. One "should not despair" and should "try repeated Credé" even though many men condemn repeated Credé as too bruising, shocking, and unsurgical. Titus<sup>5</sup> recommends several attempts at Credé for at least two hours, and then says that "manual removal must be considered." Greenhill<sup>13</sup> believes it is "safe to wait up to twenty-four hours as almost always nature will expel it" but Williams<sup>14</sup> long ago pointed out that "should the placenta be allowed to remain in the uterus, someone qualified to remove it manually should be in constant attendance." DeLee<sup>15</sup> believes one may safely wait, not one, two, three, nor four nor twenty-four hours, but eight or ten hours, although he states that after one hour the third stage is pathologic and Credé should be done. If at the end of an hour the condition has become pathologic, why procrastinate? Calkins,<sup>16</sup> moreover, points out that "expulsion of the placenta into the lower segment or vagina occurs spontaneously in only a small percentage of patients. The attendant should, therefore, express or aid the patient to expel the placenta." He found that of 1,577 cases, the placenta separated in 69 per cent in less than five minutes. He goes on to say that "this is in sharp contrast to our older ideas of 15, 20, or 30 minutes for the duration of the third stage." The cautious attitude expressed by

many writers is due chiefly to the fear of invading the uterine cavity and thereby producing sepsis. Williams<sup>14</sup> insisted that it was dangerous to invade the uterine cavity. Jellet<sup>8</sup> alone feels that the risk of manual removal "is very small, indeed" if only we "wear rubber gloves," a request with which it certainly is not too difficult to comply. In addition, certain of these disagreements, and the cautious attitudes to be found in modern texts are due to the tradition that the expulsion of the placenta is an easy, natural, normal process and the rule. I do not believe that this is true in the narcotized, anesthetized patient. I believe, too, that the traditional hands-off policy is due to teachings directed at the lowest possible levels of skill, or rather lack of skill, in the profession. On the contrary, Ricci and Marr<sup>17</sup> believe that "obstetrics is a surgical and not a medical specialty" and that the obstetrician should "absorb the gynecologist's surgical skill in the pelvis" and "his appreciation of the structure and function of the soft parts of the vaginal canal." It is not surprising that infection after manual removal of the placenta is comparatively common if the operation is not performed until long after delivery when bacteria have invaded the uterus; until after many brutal attempts at Credé have been practiced; until after the patient has lost too much blood. After three hours the uterine cavity is loaded with bacteria, according to Leff.<sup>1</sup> Prolonged anesthesia is not good for a patient. All writers point out the danger of continuous or intermittent losses of small amounts of blood, a state of affairs which frequently results when one waits indefinitely for the completion of the third stage of labor.

The technique followed here is not new. In fact, in some ways it is a reversion to the practice of immediate removal of the placenta, manually if necessary, so common in the middle of the nineteenth century. The procedure advocated here has been used on 900 private patients with good results. The principles underlying this procedure will be briefly stated; then the steps outlined and the results given. The bases of the management and treatment here advocated are: 1. A belief that the placenta separates rapidly. 2. The belief that analgesics and anesthetics tend to interfere occasionally with a complete separation and tend to delay this rapid and complete separation, but that ergonovine intravenously with the delivery of the child will restore this normal mechanism. 3. The belief that the anesthetized patient will not expel the placenta but that simple, safe, surgical procedures will.

**Procedure:** 1. As soon as the baby's anterior shoulder is delivered, one ampule of ergonovine is given intravenously and the cord is clamped and cut. (Twins must be ruled out, and for this reason I do not feel that the use of intravenous ergotrate is safe in clinic practice.) 2. The clamp on the placental end of the cord is released and what blood is left in the cord and placenta is allowed to flow out thereby reducing the bulk of the placenta. (If the baby is not narcotized and there is no

hurry in its resuscitation, most of this blood can be milked into the baby with benefit to the latter.) 3. The hand is placed on the fundus. If the ergonovine has been timed properly, the uterus will have contracted vigorously and the already separated placenta is expressed into the vagina and then into the basin. If there has been a delay in the administration of the ergonovine or a rather deep anesthesia has been given, it may be necessary to wait for the very vigorous contraction that the ergonovine causes. Expression is then performed. If the placenta does not come into the vagina, a minute is allowed to elapse and then pressure is repeated. If it is not expelled with this maneuver, the cord is pulled upon, always with one hand on the fundus to make sure that the uterus is hard. DeLee<sup>15</sup> condemned this practice, but admitted that it is "not dangerous in skilled hands." Over 90 per cent of my patients are delivered by the first two, and if necessary the third maneuver, within three or four minutes. 4. Should the placenta still be present in the uterus, the cervix is examined and if the membranes are found across the internal os, following Leff's<sup>1</sup> recommendation, the finger (or a snap) is passed at the side of the cervix. Frequently, a fair amount of blood escapes and the placenta is then expressed by fundal pressure. 5. Should the placenta still be in the uterus, the old recommendation of Edgar<sup>18</sup> made in 1903, is followed. He stated that when the placenta was adherent and Credé failed, he found that if he passed a few fingers through the cervix, that he could grasp the lower end of the placenta and with the outer hand on the fundus to insure a firm uterus, the placenta could be readily drawn from the uterine cavity. I find it necessary to do this in about 6 per cent of the patients. 6. In about one case in 60, I find that these maneuvers are not enough and thereupon change gloves, use antiseptics freely, and pass my hand into the uterus, finding usually a firmly contracted uterus holding an already separated placenta. The placenta is firmly grasped and withdrawn. Occasionally, I find that the placenta is not completely separated. I remove the placenta about one-half as often again as in the statistics given by Jellet,<sup>8</sup> and about twice as often as shown by the recent statistics of Schwartz.<sup>9</sup> I believe that the increased frequency is more than compensated for by the fact that it is done before the patient has lost blood, and before the uterus contains bacteria. Moreover, I feel that the dangers of manual removal of the placenta have been overemphasized. I think that many obstetricians today conduct the third stage of labor in the manner outlined up to the point of manual removal but then wait if the previous maneuvers have failed. Thus, Greenhill<sup>19</sup> advises waiting until the effects of the ergonovine wear off, if the placenta has not separated. 7. After the placenta is out, the uterus is anteflexed over two fingers passed against the anterior lower segment following the recommendation of Leff,<sup>1</sup> and the uterus vigorously massaged removing any clots or liquid blood.

**Results:** There have been 900 private patients delivered through the vaginal canal. The maternal morbidity has been insignificant.

	Number	Percentage
(1) Puerperal sepsis		
(a) Phlebitis	1	0.11
(2) Postpartum hemorrhage	8	0.88
(a) Due to cervical lacerations	4	0.44
(b) Due to inertia	2	0.22
(c) Due to retained placental tissue	2	0.22
(3) Maternal mortality	0	

The case of puerperal sepsis was one of phlebitis. This patient had a normal quick delivery of the placenta without bleeding. The postpartum course was uneventful. Phlebitis developed on the fifteenth day, two days after the patient was home. Of the eight cases of postpartum hemorrhage, four were due to cervical lacerations requiring sutures and due, therefore, to the method of delivery or mechanism of the second stage, and not to the conduct of the third stage. Of the remaining four cases; two were cases of delayed postpartum hemorrhage both with normal delivery of the placenta. One of the patients had twins, and the uterus was allowed to fill up three to five hours post partum. The other patient also had a secondary hemorrhage about two hours post partum, and required packing as did the first patient. Two other patients had bleeding after they were home, required a curettage because of excessive bleeding, and revealed small pieces of placental tissue. Both of these patients had the placenta removed by pressure on the uterus with the finger through the cervix without the admission of the whole hand into the uterus. Undoubtedly, a small part of the placenta had not completely separated in these patients and examination did not reveal the defect. Probably the examination of the placenta was too cursory. In one other patient in this series, a defect was found in the placenta and placental tissue was immediately removed from the lower part of the uterus. No cases of contraction of the cervix have been noted.

#### Summary and Conclusions

1. The available clinical and experimental evidence indicates that the placenta separates from the uterus immediately at the end of the second stage of labor, or within one or two postpartum contractions.
2. General anesthetics and large doses of sedatives tend to delay the speed of this mechanism and in some cases interfere with the completeness of it, but ergotrate intravenously following the delivery of the child tends to restore the mechanism to normal.
3. Separation of the placenta from the uterine wall and expulsion of the placenta into the lower uterine segment or through the cervix are different processes. The first is accompanied by no signs, whereas, the second is accompanied by a rising up of the uterus, the descent of the cord, and sometimes bleeding.
4. The distinction between these two processes is not always clearly maintained, and this accounts in part, for the contradictory advice found in modern texts as regards the conduct of the third stage of labor.
5. The bases for the procedure here advocated are given, the steps of the procedure are detailed, and the results in 900 consecutive vaginal

deliveries in private patients are stated. This active form of treatment which terminates the third stage of labor within five to seven minutes is believed to give excellent results.

The writer wishes to express his appreciation to Charles J. Kickham, M.D., Chief of the Obstetrical Service of St. Elizabeth's Hospital, Boston, Mass.

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## CYCLIC OVARIAN CHANGES IN ARTIFICIAL VAGINAL MUCOSA

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**T**HIS case demonstrates the finding of cyclic ovarian changes in the mucous membrane of an artificially-produced vagina, in a girl presenting a congenital absence of uterus, vagina and hymen. These changes have been found by examining the cells desquamated using the vaginal smear method of study. This artificial membrane was induced to grow up from the vulval mucous membrane below. Vaginal smear studies taken daily over a period of two months show the normal variations of the morphology of the squamous epithelial cells found in the follicular (regenerative) phase and in the luteal (secretory) phase, and it is possible to estimate approximately when ovulation occurs, and when menstruation would occur. They show further, a normal fluctuation of the cornification count from week to week, the cornification curve representing variation in the estrin level showing a cyclic rise and fall during a month, which would appear to be within normal limits.

In order to reveal the true significance of these findings, it would perhaps be best to describe briefly the technique used in producing the new vagina.

The patient was a girl of 18 years who presented herself with a history of amenorrhea. Inspection revealed an attractive girl with apparently normal secondary sex characteristics. Pelvic examination showed normally developed labia and urethra, but no trace of any vagina or hymen. Rectally, no uterus or other pelvic organs were palpable. Closer examination showed normal physical development in all other respects. The breasts were somewhat smaller than average, and pubic hair was not profuse in quality, resembling the picture of a girl who had just reached puberty.

**Method.**—The patient was hospitalized, and under anesthesia, an opening was made between the bladder and rectum to admit one finger. No further penetration was attempted at this time because of the extremely thin membrane between the rectum and bladder. The new passage was devoid of any epithelial lining, and in an effort to keep it open, a wax mold (dental wax) was inserted, lubricated with sulfathiazole paste.

The patient was allowed to leave the hospital in a few days, the obturator held in place comfortably by a common menstrual belt and pad. She was seen each week, and the mold removed, the cavity cleaned out, and the marginal rim of the vulval mucous membrane was cauterized with 20 per cent silver nitrate. On each visit, it was observed

that the squamous epithelial zone had crept a little higher up the canal forming a sleeve around the obturator. This gradual upgrowth was enhanced further by the fact that the mold was allowed to protrude about one inch below the vulva, and the patient was advised to sit on

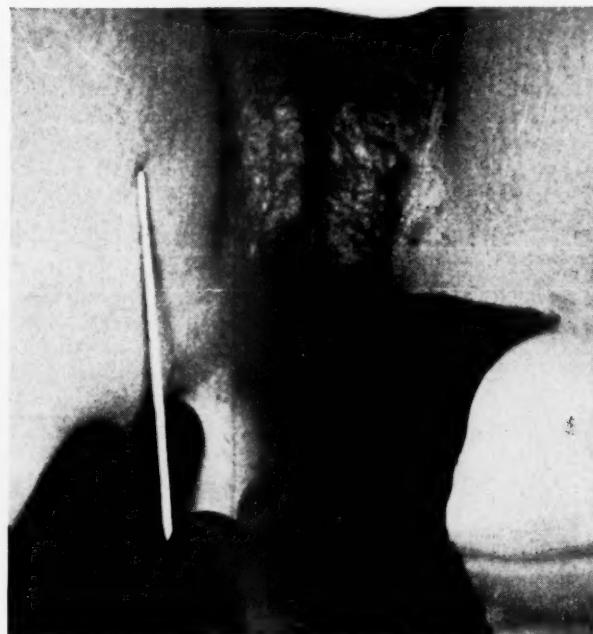


Fig. 1.—Showing external genitalia and digital examination of artificial vagina.

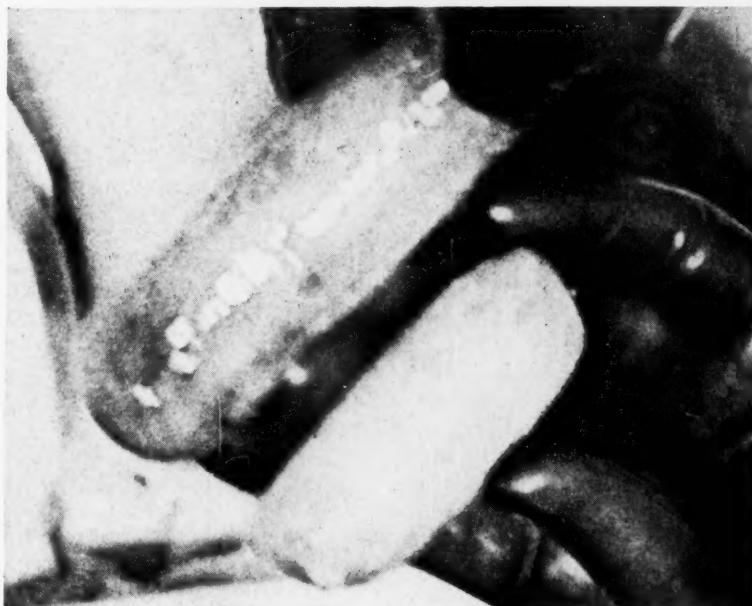


Fig. 2.—Showing two dilators (wax molds) worn successively in the process of deepening and epithelialization of vagina.

this in such a way as to produce constant upward pressure. At the end of six weeks, the patient was readmitted to the hospital for a few days, and under sodium pentothal anesthesia, the passage was dilated and deepened and a larger obturator was inserted.

This procedure was repeated at one- to two-month intervals, four separate sizes of obturator being used successively. It is noteworthy that throughout this period the patient was ambulatory, no major operative procedure was necessary and she was able to continue her work except for a three- or four-day period following each admission.

Vaginal smears were taken at intervals from the squamous zone, and the cells desquamated exhibited a variable degree of cornification at an early stage indicating the presence of estrin. This finding confirmed ovarian secretion even before it was known for certain that the ovaries were present.

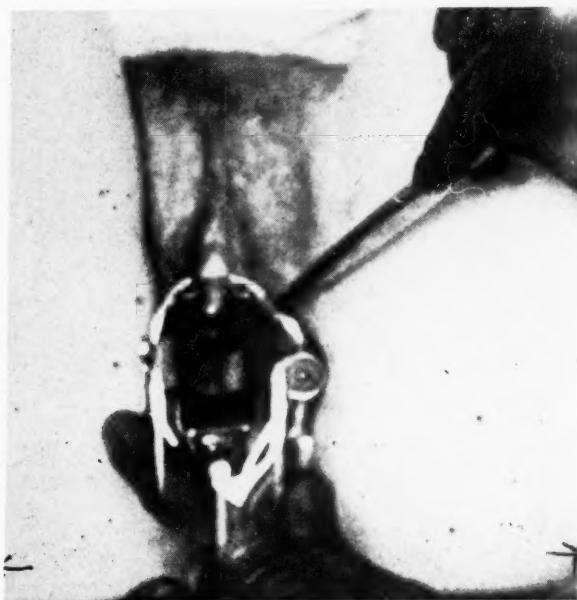


Fig. 3.—Speculum examination showing capaciousness of new tract. Small granulating spot persists at top of vault at this time.

As a sleeve of squamous epithelium gradually grew higher up the canal, the area of granulation tissue diminished. At no time was there difficulty encountered with bleeding, infection or toxic absorption from this raw area.

Six months from the initial operation epithelialization of the new vagina appeared complete. At present the passage accommodates the large obturator shown (Fig. 2), which measures 5 inches by 1½ inches (diameter). When the mold is removed, the epithelium contracts slightly presenting the same corrugated appearance as the normal vagina. Indeed, the new tissue resembles closely vaginal epithelium in all respects and pelvic examination reveals similar findings to what one would expect in a woman who has had a total hysterectomy. The ovaries are readily palpable. Following completion of the vaginal passageway, an attack of acute appendicitis permitted a laparotomy

at which time it was possible to take photographs of the pelvic floor. The findings were quite interesting. The ovaries and rudimentary tubes were present, but there was no uterus and the pelvic floor was perfectly smooth. Extending caudally from the region of the ovaries were two cord-like structures of muscular appearance which terminated blindly in a bulbous nodule on each side just two inches caudal to the ovaries. A few strands of tissue of the same appearance passed on down to merge with the flat pelvic floor. The interpretation is that the nodules are the anlage of the Müllerian duets which failed to descend sufficiently to unite in the midline to form the uterus and vagina, while the strands of tissue which reached the pelvic floor are the rudiments of the duets of Gartner.



Fig. 4.—Abdominal laparotomy, tenaculum holds ovary. Note absence of uterus. Pelvic floor is flat except for ridge between bladder and colon.

Clinically, at the present time the vagina would appear to be of normal dimensions, but it is still necessary to wear the obturator intermittently to prevent shrinkage. This has been observed to occur slowly if the mold is left out many days in succession. There is no muscle wall in this new vagina to help it maintain its tone, and capaciousness. The patient is at present engaged and hopes to marry in the near future, the prospects of infertility having been clearly outlined to the fiancé. Probably following marriage the obturator will not need to be used so frequently.

*Vaginal Cytology.*—Vaginal smear studies were made following the completion of squamous epithelialization. The results revealed that the new mucosa is desquamating, reacting to the ovarian hormones in a similar manner to the normal vagina. Daily smears were prepared in our Department of Vaginal Cytology, interpreting the cyclic changes as described by Papanicolaou<sup>1</sup> and De Allende, Shorr and Hartman.<sup>2</sup> In our laboratory, we have worked out a technique of doing a cornification count comparable to a blood count. The number of cornified cells present out of a total of one hundred epithelial cells counted, gives the percentage. This, it is felt represents fairly accurately (when done by

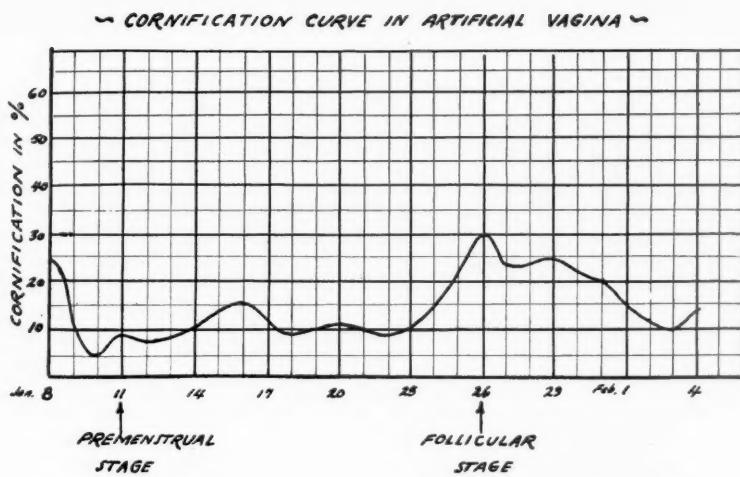


Fig. 5.—Showing cornification curve. Arrows show time of smear (below) illustrating two stages.

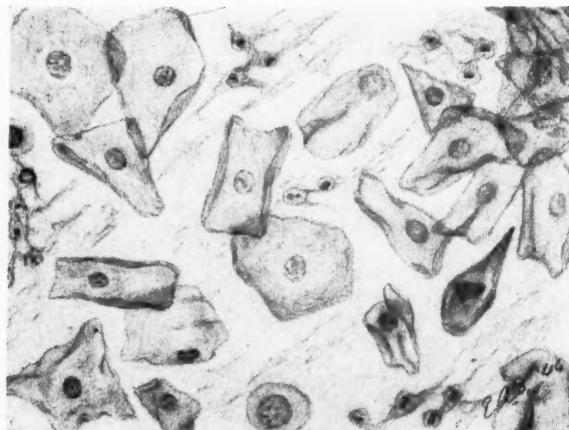


Fig. 6.—Showing premenstrual (luteal) phase. Note folding and clumping of cells which stained basophilic.

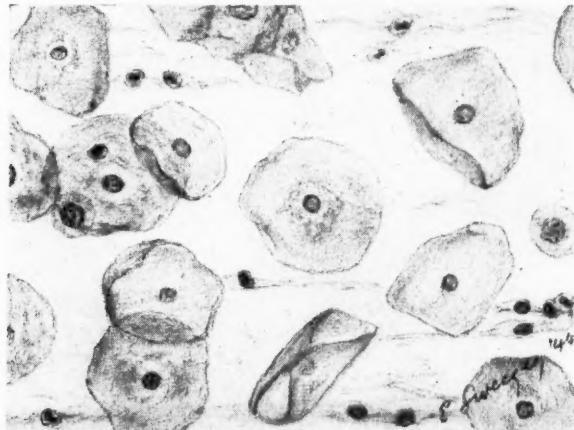


Fig. 7.—Showing follicular stage. Many of the large wafer-shaped cells are cornified or precornified. Tiny cells are leucocytes from granulating spot in vaginal vault (present in both phases).

a standard routine) the quantitative level of estrin at that particular time. Daily cornification counts over a period of several weeks when charted on a graph give a cornification curve which will show the ebb and flow of the secretion of this hormone. (Fig. 5.) In this case plotting the cornification counts reveals a cyclic trend as shown. Study of the smears from week to week has revealed two different phases which seem to correspond to the regenerative or follicular (Fig. 7), and the secretory or luteal (Fig. 6). Note that in the follicular phase the cells are more discrete, the cornified cells are large and wafer-shaped with a small deep-staining nucleus. The cornification count is highest during this phase and many precornified cells and cells of the estrogenic superficial series are also present. In the luteal phase (Fig. 6), the cells show more folding and shrinkage, there is well-marked clumping of epithelial cells, the cornified cells diminish and the basophilic-staining estrin withdrawal and luteal superficial cells become more prominent. (Fig. 7.)

It would appear from the smear studies that while there is evidence of cyclic changes, the degree of ovarian activity in so far as estrin-secretion is concerned, is on the low side of normal. Many normals show a cornification level up to 60 per cent or 100 per cent. The highest level reached during the cycles under investigation was 40 per cent.

From the cornification curve and the finding of the two phases, the approximate time of ovulation and of menstruation may be postulated. That ovulation is occurring cannot be said with absolute certainty, but there would appear to be presumptive evidence of this phenomenon.

It has been stated that only tissues derived from the Müllerian ducts respond to the ovarian secretions. In this case, the vaginal tube definitely had no Müllerian origin, as it grew up from the vulva under our eyes. Yet, in its new environment, it is very definitely reacting to the ovarian secretions. It would appear that the same cyclic phenomena occur in the vulval squamous epithelium.

### Summary

A case of congenital absence of uterus, vagina and hymen has been presented with a simple method of producing a satisfactory artificial vagina without resort to major surgery, while the patient may be kept ambulatory.

Cyclic ovarian changes have been demonstrated in the artificial vaginal mucosa with differentiation of the two phases (follicular and luteal) in the vaginal smears. A cornification curve representing the variable quantitative level of estrin secretion would appear to follow the approximate anticipated pattern in accord with the cyclic phases. The approximate times of ovulation and menstruation have been hypothesized.

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## LYMPHOGRANULOMA VENEREUM IN PREGNANCY

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LYMPHOGRANULOMA venereum is a disease of many aliases—lymphopathia venereum, lymphogranuloma inguinale and Nicolas-Favre disease. This last name has special reference to the type associated with inguinal adenopathy which was described in 1913, by Nicolas and Favre. In 1928, Frei first demonstrated that the skin test which bears his name, was frequently associated with stricture of the rectum. Two years later, in 1930, Hellerstrom and Wassen isolated the virus which causes this disease and transmitted it to monkeys by intracerebral injection. The past decade has witnessed the transmission of the disease to a host of other animals, the use of complement fixation tests and the development of a mouse-brain antigen for skin testing.

Lymphogranuloma is caused by a virus which is about the same size as the virus of smallpox—0.1 to 0.2 microns. The virus readily passes through a No. 5 Berkefeld filter. Cytoplasmic granules which are seen in the exudate, are believed to be due to the virus.

There is an apparent increase in the incidence of the disease, but this may be due to increased recognition. There were, during the years 1934 to 1940, according to Grace, 35 patients with lymphogranuloma venereum admitted annually to the New York Hospital. This constitutes 0.1 per cent of the total admissions.

The disease begins insidiously. After an incubation period of 2 to 3 weeks, a primary lesion develops. This may be either an ulcer or an herpetiform lesion. It is located on the vaginal or rectal mucosa, or on the surrounding perineal skin. Because of its innocuous character and transient nature, it is rarely seen. During the next 10 to 50 days, systemic involvement occurs. The Frei test which like the tuberculin test merely indicates sensitivity, then becomes positive and remains so for life.

There are three main types of lymphogranuloma venereum—the anorectal which is the largest group, comprising 60 per cent of the cases, the inguinal which accounts for 25 per cent of the cases, and lastly the genital type which consists of only 10 per cent of the cases.

### TYPES OF INVOLVEMENT

Anorectal	60%
Inguinal	25%
Genital	10%
Miscellaneous	5%

In the male, the primary lesion is usually on the penis. Because of the lymphatic drainage the inguinal glands are involved, while anorectal involvement is less common in the male. In the female, however, the inguinal nodes are rarely affected; genital and anorectal localization being more common. In the inguinal type, there are indurated inguinal nodes, which later suppurate, leaving draining sinuses. It is a clinical observation that patients with inguinal adenitis rarely have anorectal infection. During this period, there may be systemic symptoms—such as fever which is remittent in type, headache, malaise and arthritic pains. The genital type is either an ulcerative lesion (the so-called esthiomene), or else shows the late changes of lymph stasis and fibrosis which result in elephantiasis. Incidentally, an indolent vulvovaginal ulcer is the most infectious variety of lymphogranuloma venereum. By far the greatest percentage of patients with lymphogranuloma venereum has anorectal involvement. This is especially true of women. In the early stages, there is a proctitis manifested by bloody, purulent discharge from the rectum. In the later stages, there is stricture formation which results in increasing constipation and a decrease in the diameter of the stool. These strictures are usually single, but may be multiple. They are either annular or barrel-like, and may obstruct from 1 to 10 centimeters of the rectal mucosa. Frequently, it is not the fibrosis of the strictured area which causes the obstruction, but the superimposed edema from lymphatic and venous stasis. Other rare types of lymphogranuloma venereum include edema of the eyelids and stricture of the urethra.

#### LOCALIZATION

EARLY	LATE
Primary lesion	Rectal stricture
Inguinal adenitis	Elephantiasis of the vulva
Proctitis	

When any of the above symptoms and signs are present, the diagnosis is readily made by the Frei test. This consists in the intradermal inoculation of an emulsion containing inactivated virus. Depending upon its source, the virus is known as human, mouse brain or chick embryo. When the test is read in 48 to 72 hours, an erythematous area, which is over 6 mm. in diameter and may be papular, vesicular or pustular, is considered positive. Lygranum antigen has also been used in complement fixation tests with 90 per cent accuracy. A biopsy may be taken which shows the granulomatous changes. There is usually an associated secondary anemia; the sedimentation rate is increased; and there is also a hyperglobulinemia with reversal of the A/G ratio.

The early stages other than the inguinal adenitis are rarely treated, because they are rarely recognized. The bubos may be incised. Fuadin and tartar emetic have been used. Sulfonamide derivatives are now used for the acute proctitis and ulcer stages. Frei antigen has also been used both subcutaneously and intravenously in gradually increasing

dosage. For the late rectal stricture x-ray, medicated enemas and dilatation of the rectum have been used with little effect. For advanced stricture colostomy, either alone or with resection of the rectum, may be necessary.

In obstetrical practice, we rarely see the acute phases of lymphogranuloma venereum since they are so ephemeral. The most common obstetrical complication is the rectal stricture. Even at that, lymphogranuloma venereum is an obstetrical rarity. This may be due to the fact that sterility is associated with the later stages of lymphogranuloma venereum. Some idea of its incidence may be gained by realizing that at the Chicago Lying-in Hospital, only one case has been seen in the past 10 years. In the Provident Hospital, Chicago, there have been 17 cases in the past 5 years. At the Sloane Hospital during the past 4 years, there have been 7 cases in 7,000 deliveries.

#### INCIDENCE OF LYMPHOGRANULOMA VENEREUM IN PREGNANCY

Sloane Hospital	1:1,000
Provident Hospital	17 cases in 5 years
Chicago Lying-in	1 case in 10 years
New York Lying-in	11 cases in 10 years (1:2,500)

The largest series in the literature consists of 18 cases reported by Wilson and Hesseltine from Chicago. In this group, 2 therapeutic abortions were done because of marked perirectal fixation and previous colostomies. Of the remaining 16 patients, 13 delivered spontaneously, 1 was delivered by forceps, and 2 by cesarean section. Both cesarean sections were performed because of dystocia due to soft tissue masses. It is interesting to note that of the 14 patients who delivered spontaneously, 2 had colostomies.

#### LYMPHOGRANULOMA VENEREUM AT CHICAGO LYING-IN HOSPITAL

18 Cases
2 Therapeutic abortions (performed because of previous colostomy and perirectal fixation)
16 Term deliveries
1 Forceps
13 Spontaneous
2 Cesarean sections (because of dystocia caused by soft tissue masses)

Of the 7 cases reported from Sloane Hospital, 1 was terminated at 4 months because of associated myomas as well as rectal stricture. Of the remaining 6 cases, 4 were delivered spontaneously and 2 by cesarean section. It is of passing interest to note that in one case a colostomy was performed simultaneously with the cesarean section. Their most interesting patient was a colored multipara who had had bleeding for 10 years from a rectal canal which was 0.4 em. in diameter. The Frei test for 6 years had been positive as well. When she fell into labor, two weeks prior to term, the presentation was breech. As the cord prolapsed, it was replaced and a No. 3 Voorhees bag was inserted. Eight hours afterward, the patient was easily delivered of a stillborn infant, but 4

hours after delivery, she complained of abdominal pain and distention; 17 hours after delivery, an enema was given without return, and 21 hours after delivery she died. Autopsy revealed 1,500 c.c. of fluid in the peritoneal cavity, and a transverse rupture of the rectum above the site of the rectal stricture. A similar case is reported by Gaines and McDowell. An unregistered primigravida entered late in labor, at which time rectal examination revealed a tight stricture which extended as far as the finger can reach and marked thickening of the rectovaginal septum. After delivery by forceps was attempted unsuccessfully, a version and extraction were performed. The chin was impacted in the birth canal and was delivered only with great pressure. The patient died 5 hours following delivery, post mortem revealing a transverse tear in the rectum about 9 cm. above the anus. Unfortunately, there was no opportunity to do a Frei test.

#### Case Reports

In the past 11 years, there have been 11 patients with lymphogranuloma venereum in the New York Lying-in Hospital. The salient points in the histories of these patients will be briefly outlined:

1. E. N., a colored para 6, gravida 10, had a positive Frei test as the only evidence of her involvement with lymphogranuloma venereum. All her deliveries were uncomplicated.
2. D. M., a Porto Rican had a fistula-in-ano and a positive Frei test in 1933. There was no other evidence of the disease. Four years later in 1937, a full-term spontaneous delivery occurred.
3. R. W., a white multipara had an acute proctitis and a positive Frei test in February, 1938. In July, 1938, a spontaneous abortion occurred and in 1939, a full-term spontaneous delivery occurred. There was no stricture formation.
4. P. B., a colored para 0, gravida 3, had syphilis and a rectal stricture. She died in the sixth month of pregnancy of arsenical encephalitis.
5. C. M., a Porto Rican multipara had had 4 uneventful pregnancies. During her fifth pregnancy, she developed rectal bleeding, and pencil-like stools. An annular stricture was discovered 6 cm. above the sphincter; Frei test was positive and biopsy showed an acute granuloma. The delivery was without event.
6. E. W., a colored primipara had been known for the past 8 years to have a stricture about 5 cm. above the sphincter. Her Frei test was positive. Because of increasing constipation, a colostomy was contemplated, but was not performed because of the marked decrease in constipation which accompanied the pregnancy. An uneventful spontaneous delivery occurred.
7. A. W., a colored para 1, gravida 3 had two therapeutic abortions elsewhere because of a rectal stricture which began about 3 cm. above the sphincter. A full-term spontaneous delivery occurred after 6 hours of labor.
8. F. R., a colored multipara had previously had a colostomy performed because of rectal stricture. Her Frei test was questionable. In early labor, a vaginal examination revealed induration about the rectum

which is described as feeling like a "rubber pipe." A forceps delivery was performed with the accompaniment of a third degree tear.

9. E. P., a colored multipara had inguinal bubos 17 years previously, and had been constipated for 3 years. The Frei test was positive, and a rectal stricture was found 5 cm. above the sphincter. A vaginal examination in labor revealed no involvement of the posterior vaginal wall. A midforceps delivery was performed without difficulty.

10. R. M., a colored primigravida had noticed increasing constipation for 6 years and the Frei test had been positive for 2 years. At that time, a stricture was discovered 5 cm. above the sphincter. She was treated for associated lues. A vaginal examination during labor showed no fixation of the posterior vaginal wall. A low-forceps delivery was uneventfully performed.

11. H. M., this last case is reported in greater detail because it is the only case of lymphogranuloma venereum associated with rupture of the uterus that has been reported. The rupture, however, was not caused by the lymphogranuloma venereum as far as we can tell. This colored para 4, gravida 6, had been known to have a rectal stricture about 5 cm. above the sphincter, and a positive Frei test for 7 years. During this period, 4 spontaneous deliveries occurred. She was simultaneously treated for syphilis. The first stage occupied three hours. After 1 hour of second stage, the fetal heart slowed. The patient who had previously been noisy, became quiet. The nurse who was holding the fundus stated that it changed in shape. Since the vertex was on the perineum in R.O.A. position, preparations were made for a forceps delivery. The right blade of the forceps was readily inserted. As the operator's left hand was inserted into the vagina preparatory to the application of the left blade, the head rose out of the pelvis and the patient's blood pressure abruptly dropped to 65/40. Acting on the diagnosis of rupture of the uterus, a laparotomy was immediately performed. On opening the peritoneum, a deadborn infant and the placenta were found lying free in the peritoneal cavity. On the anterior half of the lower uterine segment just below the level of the internal os, was a semicircular site of rupture which closely resembled the incision for subtotal hysterectomy. A subtotal hysterectomy was performed. The pathologic report stated that there was no involvement of the pericervical tissue by lymphogranuloma venereum. The patient had an uncomplicated postoperative course.

#### NEW YORK HOSPITAL—EXPERIENCE

##### 11 Patients

###### 3 Without stricture

- 1 Positive Frei test alone
- 1 Fistula-in-ano
- 1 Acute proctitis

###### 8 With stricture

- 1 Died of arsenical encephalitis occurring in the sixth month of pregnancy
- 3 Delivered spontaneously
- 3 Delivered by forceps
- 1 Delivered by cesarean section (rupture of uterus)

It is of note that one of the patients who delivered vaginally, had a colostomy of 10 years' standing.

The last point of interest is whether lymphogranuloma venereum is transmitted to the fetus. Most observers believe that if it is, it is not

by intrauterine spread, but rather during and after birth. Dick has reported many positive Frei tests in early life. Wilson performed Frei tests on 13 babies; 12 of these were negative; the thirteenth which was positive on the infant's third and tenth days was negative at three months. It has been adequately proved that lymphogranuloma venereum per se does not increase the stillborn rate.

### Summary and Conclusions

In reviewing these histories, certain factors stand out. The patients are usually colored. They are almost invariably syphilitic as well, so that when patients have a rare venereal disease one can almost infer that they will have a more common venereal disease. These patients are frequently anemic. In deciding upon the type of delivery, a vaginal examination before the onset of labor or in early labor will give the most information. If there is marked perirectal fibrosis, or soft tissue masses, or fixation of the posterior vaginal wall, vaginal delivery will be fraught with difficulty and danger. It is interesting to note that in both the cases of rupture of the rectum, breech extraction was performed. Hence, when the presentation is breech in a woman with a stricture of the rectum, external cephalic version should be attempted.

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## CALCIFICATION IN CEPHALHEMATOMATA OF THE NEWBORN INFANT

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**C**EPHALHEMATOMATA of the newborn infant are localized collections of blood beneath the periosteum of one of the bones of the cranial vault. They may be single or multiple. The entire periosteum covering that particular cranial bone is elevated. Cephalhematomata may appear after a normal delivery, but they are certainly more frequent after long hard labors, particularly if there has been operative interference.

The lesions themselves are not particularly dangerous, but since they are more common after difficult labors, babies presenting them bear most careful watching. The swelling appears the first or second day after delivery, and usually absorbs rapidly after the first week of life. Most of them are completely absorbed by the third week. Since they usually run this innocuous course, the common plan of treatment is one of utmost conservatism. The mothers who are naturally alarmed by this unsightly bump on their babies' heads are bluntly told, "Forget about it. It will go away."

Unfortunately, all of them do not go away. A very appreciable number calcify, forming a more or less permanent deforming lump on the child's head. While this lump is of importance only from the cosmetic standpoint, it causes the parents great concern. Since its presence can be easily prevented, we believe that more attention should be paid to the treatment of these lesions.

The pathogenesis of this calcification is of interest. As has been noted, the collection of blood is beneath the periosteum of one of the flat bones of the skull. The periosteum is adherent to the bone at its margin, and can be elevated over its entire surface. The hematoma, therefore, is sharply delineated by the margins of the particular bone which it happens to overlay. In one of the lesions which does not absorb rapidly, subperiosteal osteogenesis begins at the attached margin of periosteum all around the circumference of the bone. If absorption of the clot is completed at this time, the newly formed bone can be felt as a slight ridge or elevation around the edge of the skull plate. This gives a false sensation that the central portion of this particular bone is depressed and can be mistaken for a depressed skull fracture.

If, however, absorption of the clot does not proceed rapidly, the newly formed bone at the edge grows subperiosteally up over the dome of the bulge until at one stage only a small area at the apex of the lesion lacks a bony covering. Shortly, this is also filled in, and the hematoma is

completely roofed over with a thin pliable layer of bone. This bony covering rapidly becomes thicker and more solid until in a few weeks it clinically seems as firm as the remainder of the skull. We have serial radiographs depicting the various stages of this development.

There is now a hard bony protuberance which persists for an indefinite length of time. As the child grows, the protrusion seems to tend to flatten and merge into the general contour of the skull, but it is an extremely slow process.



Fig. 1.—Cephalhematoma completely roofed with bone, in infant five weeks old.

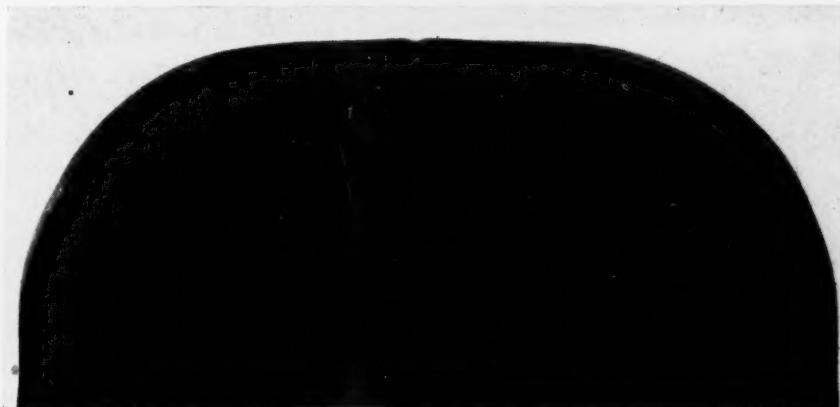


Fig. 2.—Bilateral calcified lesions persisting in child two and one-half years old.

Three radiographs illustrating the condition are presented. Fig. 1 shows a lesion completely calcified in a baby five weeks of age. Fig. 2 shows bilateral calcified lesions on the skull of a child two and one-half years of age. These had given the child's head a peculiar heart-shaped outline which, combined with a lack of hair had caused the parents great mental perturbation. These lesions are now flattening out and will probably disappear in time. Fig. 3 shows a well-marked lesion on the head of a boy ten years of age.

Dr. S. J. Webster, of Cleveland, followed one lesion which persisted for more than twenty years. Therefore, while the tendency may be toward spontaneous cure it can certainly be slow.

We have elaborated on the natural life cycle of these lesions in order to make our point concerning their treatment. As we have mentioned, absolute conservatism is usually advised. Christopher<sup>1</sup> mentions that Cushing has tried incising cephalhematomata and evacuating the clots. He is, however, hesitant to do so because of danger of infection. Very little has ever been mentioned in English literature concerning calcification of a cephalhematoma. No reference to the possibility was found since 1935. Two articles stressing the possibility have appeared in German journals during the same period. Kastendieck<sup>2</sup> presented several cases in which ossification occurred. He felt that the cosmetic result was distressing, and mentioned that incision and evacuation of the clot might be tried as prophylaxis. However, he also felt that the danger of infection probably made such a procedure unjustifiable. Ottow<sup>3</sup> presented several cases in which calcification occurred, but made no mention of treatment either prophylactic or active.



Fig. 3.—Large calcified cephalhematoma on skull of child ten years old.

From our experience we cannot agree with this absolute conservatism. We feel that the lesion should be closely watched. At the end of two weeks, most of them are absorbing rapidly. These should, of course, be left alone. In those which are not absorbing rapidly by this time, it will be found that the contents have liquified and may be easily aspirated. If a fairly large bore needle is introduced beneath the elevated periosteum, from ten to forty cubic centimeters of thick bloody liquid can be withdrawn. The cyst then largely collapses; the small amount of remaining contents rapidly absorbs and permanent deformity is prevented.

By use of standard aseptic technique, we can see no more reason to fear infection in these cases than in any other minor surgical procedure. In the past five years we have routinely aspirated those which did not absorb rapidly, and have had no trouble at all. One of the first ones which we aspirated had been allowed to progress until a thin layer of

bone entirely covered the dome of the hematomata. We introduced a stout needle through this light layer of bone and aspirated forty cubic centimeters of bloody fluid. We then mashed the fragile osseous dome down upon the underlying bone of the skull. The pieces of it could be palpated lying under the skin and periosteum, feeling like small bits of crushed egg shell. This rapidly absorbed, giving a perfect cosmetic result. On the other hand, the persistence of an unsightly bony protuberance on the baby's head is most distressing. It undoubtedly causes no untoward functional results, but is certainly a negative advertisement for the obstetrician's skill, vitiating what may otherwise have been an able or even brilliant delivery.

### Summary

Attention is called to the fact that ossification not infrequently occurs in cephalhematomata of the newborn infant. Aspiration of lesions not absorbing rapidly is advocated to prevent unsightly deformity of the skull.

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## INFLUENCE OF EPINEPHRINE UPON THE HUMAN GRAVID UTERUS\*

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RUCKER<sup>1</sup> in 1925, called attention to the fact that studies published concerning the action of epinephrine showed opposite effects in different animals and even in the same species of animals with various conditions of the uterus. In his studies on intrauterine pressures of 20 pregnant human beings, he observed that epinephrine decreased uterine activity in 80 per cent of the patients. The results of Bourne<sup>2</sup> and of those from this laboratory<sup>3</sup> indicate that in human beings, epinephrine causes an initial brief period of increased activity followed by a short period of reduced uterine activity. Recently, Brown and Wilder<sup>4-6</sup> quote these latter studies to disprove Rucker's statement that epinephrine relaxes the uterus. It is a common pharmacologic observation that epinephrine in proper dosage can produce either excitatory and/or inhibitory effects upon a number of structures innervated by the sympathetic nervous system. Both actions may be present and may tend to counterbalance each other. The present studies were undertaken to determine whether epinephrine has both stimulatory and inhibitory actions upon the human pregnant uterus.

### Methods

As previously described<sup>3, 7</sup> a balloon tied to a catheter was inserted into the uterus of patients pregnant 9 months. The balloon was then partially filled with 30 c.c. of 0.6 per cent sterile sulfanilamide solution. The balloon and catheter, by acting as a foreign body, soon induced uterine contractions. After contractions were well established, epinephrine was injected intravenously in doses ranging from 0.01 mg to 0.1 mg. The rate of injection was varied. Rapid injection requiring 3 seconds was used to simulate the usual intravenous administration. Dilution of 0.01 and 0.02 mg. of epinephrine in 20 c.c. saline allowed slow injections requiring six to ten minutes. This simulated the gradual absorption resulting from intramuscular or subcutaneous administrations. The injections of epinephrine were separated by periods of 10 to 15 minutes to permit recovery from previous administrations.

### Results

The effects of epinephrine upon the intact gravid human uterus were found to differ with the drug concentration present at the site of action.

\*Aid from a grant from Eli Lilly and Company is gratefully acknowledged.

Rapid intravenous injection of 0.1 mg. (see injection 1) caused immediate strong uterine contractions which followed each other so closely that the uterine pressure remained elevated between contractions. The increased frequency is evidence of heightened excitability, the faster rise of pressure during onset of contraction and the shorter duration of the contraction suggest that the epinephrine induced contraction may not be the normal peristaltic-like type of contraction. Two and one-half minutes after the injection the uterine pressure was low, and there was only slight evidence of uterine activity for three and one-half minutes. These results are in agreement with previously published observations of the effect of intravenous administrations.<sup>2-4</sup> Bourne and this laboratory have interpreted such records to indicate that epinephrine causes a delayed inhibition of uterine activity after the transient initial increased activity. Even though the pressures are low, Brown and Wilder interpret this delayed effect of epinephrine as evidence of sustained muscular activity.

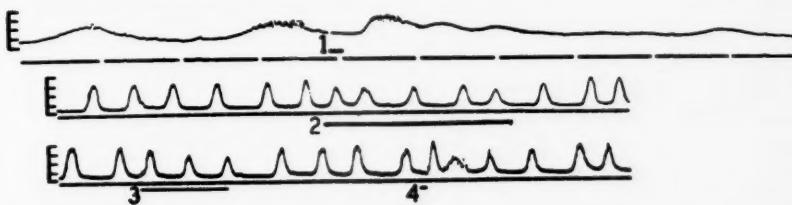


Fig. 1.—Intrauterine pressures from gravid patients recorded by direct Method. Pressure scales are shown in units of 25 mm. Hg; base lines are interrupted at one minute intervals. Solid lines above or below the time line indicate duration of injection.

1. Epinephrine 0.1 mg. in 1:1,000 dilution was injected rapidly. Note that premature contractions resulted, and that amplitude and frequency were increased. This interval of hyperactivity was followed by a period of relative quiescence.
2. Epinephrine 0.01 mg. in 1:2,000,000 dilution injected slowly. Note that amplitude of uterine contractions was decreased during time of injection, but there was no significant change in frequency or tone.
3. Epinephrine 0.02 mg. in 1:1,000,000 dilution injected approximately twice as fast as in No. 2. Amplitude of contractions again reduced, but there was no significant decrease in tone or frequency. Secured from same patient as No. 2.
4. Epinephrine 0.05 mg. in 1:10,000 dilution injected rapidly. Note marked increase in amplitude of epinephrine induced contraction following injection, followed by three contractions of decreased amplitude. Secured from same patient as No. 2 and No. 3.

It seems reasonable that the action upon the uterus might resemble that upon other structures such as the blood vessels in which inhibitory effects of epinephrine are present, and outlast the excitant effects. Since small doses can elicit this inhibitory action on blood vessels, it was considered advisable to determine their effect upon the human gravid uterus. The amplitude of the uterine contractions was decreased when small doses of 0.01 and 0.02 mg. epinephrine, respectively, in a 1:2,000,000 and 1:1,000,000 dilutions were administered slowly over a period of six to ten minutes (see injection 2 and 3). These slow injections simulate the decreased rate of absorption which occurs with hypodermic administrations. These inhibitory effects are in entire agreement with the previously published observations of Rucker,<sup>1</sup> who usually administered the drug by the hypodermic avenue. Divergent results from different laboratories may sometimes be explained by the fact that the drug was administered by different routes.

### Summary and Conclusions

The rate and avenue of administering epinephrine influences its effect upon the human gravid uterus. Administered subcutaneously, intramuscularly or very slowly intravenously, small doses reduce the amplitude of uterine contractions. Administered in larger doses, heightened uterine activity precedes the inhibition, and both effects are pronounced. These observations concern only the normal gravid uterus, but they do suggest that epinephrine may reduce Bandl's ring and retraction rings if they occur.

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## COEXISTENT ECTOPIC AND UTERINE PREGNANCY

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**S**IMULTANEOUS intrauterine and extrauterine pregnancy is one of the less common obstetrical complications. It is to be differentiated from *compound* pregnancy which is a term used to designate pregnancy intrauterine superimposed on an older ectopic pregnancy which has resulted in lithopedion formation.<sup>1</sup> This differentiation may account for the rather considerable variation in the total number of cases reviewed by various authors.<sup>2</sup> It can be said, however, that over 300 cases of simultaneous intrauterine and extrauterine pregnancy have been reported.<sup>3</sup>

Most of these cases appear to be twin pregnancies, although some apparently are gestations superimposed on those previously existing.<sup>4</sup> The condition appears to be more common during the latter part of the childbearing period, in multiparas, and in women who have a family history of multiple pregnancy. The extrauterine pregnancy may be ovarian, tubal, or abdominal.

The importance of the condition lies in the difficulty of making a correct diagnosis and in its high mortality. In one series of 170 cases, the correct preoperative diagnosis was made in only 7 cases, and in another series of 32 cases, the preoperative diagnosis was correct in only 3 instances.<sup>3</sup> Most commonly, the picture in early cases seems to be that of an ectopic pregnancy. Enlargement of the uterus is then considered to be only that usually seen associated with an ectopic pregnancy, and the intrauterine gestation is overlooked unless there be signs of an impending abortion.<sup>3</sup> Indeed, it may happen that the uterine abortion precedes the rupture of the tubal pregnancy. More than forty cases of this kind have been reported.<sup>5</sup>

The seriousness of the condition is shown by the fact that the mortality rate for the whole series of 217 cases reviewed by Gemmell and Murray<sup>5</sup> was 20.7 per cent. After excluding the cases in which the diagnosis was made only at autopsy, the rate was 14.4 per cent.

It seems to be generally agreed that the only treatment is surgical. It is advised that if the condition is discovered in the early months of pregnancy and both fetuses are living, the ectopic pregnancy should be removed. If both fetuses are living in the late months, the treatment is expectant, with laparotomy at term. If the ectopic fetus appears to be dead, removal is commonly advised; otherwise, some of these patients pass the fetus piecemeal through fistulas.<sup>5</sup>

### Case Report

M. M., a 32-year-old housewife, mother of four children, was first seen August 27, 1943, complaining of occasional nausea, and of ab-

normal flow. Her last menstrual period had begun July 15. August 6, three weeks before being seen, she had begun to have occasional episodes of slight nausea. A week later, she began to pass a few drops of dark red blood each day. Three days later she had a stem pessary, which had been inserted by an osteopath for contraceptive purposes, removed. Her symptoms continued.

On physical examination at this time, August 27, she was afebrile, and was slightly tender over all of her lower abdomen. There was a sensation of a small suprapubic mass. On pelvic examination, the uterus seemed enlarged to the size of a three months' pregnancy; the cervix seemed slightly soft. The breasts were negative. The impression was that the patient was probably pregnant intrauterine, and was threatening to abort, or that she had intramural fibroids. Urine was obtained for an Aschheim-Zondek test, and the patient was sent home to bed.

Three days later, the patient was seen at home complaining that on two consecutive mornings she had had rather severe lower abdominal cramps, similar to labor pains, and of sufficient severity so that she had wept with them. At the time of the cramps on the first day, she had had enough bright red flow to require one or two pads, but on the second morning, the flow had become dark brown in color, and was only slight in degree. Hospitalization was advised, and was carried out the same day.

The patient's past history was not of interest except for her menstrual and marital histories. Her catamenia had begun at thirteen, had always been regular in a 28-day cycle lasting 4 to 5 days without pain. She had married at 17 years of age, and had not become pregnant for six years, in spite of using no contraceptive precautions. She had then had four uncomplicated pregnancies preceding her present illness, her youngest child being three years of age.

One maternal great grandfather was a twin, and his wife was also a twin. The patient's brother was the father of twin sons. There was no twinning among the husband's relatives. The systemic review was noncontributory.

The positive physical findings of interest were limited to the abdomen and pelvis. The abdomen was obese. The upper quadrants were negative to palpation. The lower midabdomen was slightly tender, and there was a sensation of suprapubic resistance. There was very slight tenderness, and very slight rebound tenderness in both lower quadrants. The perineum was relaxed. Bluish discoloration of the vulva was not noted. The vaginal wall was not unusual. The cervix seemed slightly soft. Pain was induced on motion of the cervix. The uterus was enlarged to approximately the size of a three months' pregnancy. No masses were palpable in the adnexa. Both adnexal areas were very slightly tender. There was no bulging or tenderness in the cul-de-sac.

Examination of the urine showed a pale amber, cloudy specimen, of acid reaction and with a specific gravity of 1.018. Albumin 0, sugar 0, acetone four plus. The sediment showed an occasional white blood cell, a few red blood cells, and a moderate number of epithelial cells. The hemoglobin was 88 per cent (Sahli); R.B.C. 4,380,000; W.B.C. 6,950. There were 74 per cent polymorphonuclear cells, 23 per cent lymphocytes, 2 per cent stab cells, and 1 per cent basophils. The Kahn test was negative. A preliminary diagnosis of intrauterine pregnancy

with threatened abortion was made, with the possibility of an extra-uterine pregnancy indicated as a second choice.

The patient's hospital course was uneventful and afreble. She continued to have a small amount of dark brown, foul-smelling discharge, but did not have any cramps while in the hospital. She was given 1 mg. of progesterone intramuscularly daily. The Aschheim-Zondek test taken before admission was reported positive. On September 4, 1943, five days after admission, pelvic examination showed no tenderness or masses in the vaults, nor any tenderness in the cul-de-sac. The patient was discharged with a final diagnosis of threatened abortion.

At home she stayed in bed, and progesterone was given every second day. After riding home in a car, her bleeding increased slightly for one day, but this subsided so that she simply spotted a small amount of brown discharge daily. There was no more pain. Gradually she got up and about, and five days later came into the office complaining of being weak and chilly. She had no fever. The hemoglobin was 88 per cent (Haden-Hausser). The progesterone was stopped, the patient was allowed restricted activity and was told to return in a week.

Five weeks later, she returned saying that she felt somewhat weak and had little appetite. She had had no more pain. She continued, however, to have a small amount of brown discharge. At this time, the fundus was felt 4 cm. below the umbilicus. The blood pressure was 110/70; weight 173 pounds. The urine was normal. The pelvis was not examined.

Three weeks later, November 8, 1943, sixteen weeks after onset of her last normal menstrual period, the patient was seen at 11 A.M. at home, complaining of recurrence that morning of lower abdominal pain. The pain was steady, and radiated down the anterior aspect of the right leg. The fundus was just below the umbilicus, and was slightly tender. There was a slight tenderness in the left lower quadrant. Since it was thought the patient might be miscarrying, a rectal rather than a pelvic examination was made. The cervix was closed. No conclusions regarding the vaults could be drawn from rectal examination. The pain was not severe. She was given medication for pain, and was told she would be seen again in the evening unless she reported signs of impending termination of her pregnancy.

Six hours later, the family called saying that the patient had been vomiting ever since shortly after the morning visit, and that the pain had become more severe. At first glance, it was obvious she had been bleeding internally, although her blood pressure was 110/50, and her pulse 96. She was pale and sweating. She was given morphine sulfate gr.  $\frac{1}{6}$  subcutaneously, and an attempt was made to secure an ambulance immediately. When she was placed in the ambulance, an intravenous infusion of 5 per cent glucose in saline solution was begun, but it would not run due to our inability to raise the flask high enough. Because of delays in getting an ambulance and distance, it was  $4\frac{1}{2}$  hours before the patient could be admitted to the hospital 27 miles away.

On admission, temperature was 98.8, respiration 20, pulse 100, and blood pressure 110/40. The patient was pale, sweating, complaining of abdominal pain, fullness in the abdomen, and shortness of breath. The mucous membranes were extremely pale; the tongue was dry. The lungs were clear. The heart was negative. The abdomen appeared distended, and there was very acute tenderness and spasm throughout.

The fundus could be felt just below the umbilicus. Since it was apparent that surgery was necessary, pelvic examination was omitted.

The hemoglobin was 61 per cent (Sahli); R.B.C. 3,500,000, W.B.C. 12,550 with 75 per cent polymorphonuclear cells, 16 per cent lymphocytes; 4 per cent stab cells; and 2 per cent eosinophiles. The urine (catheterized) was clear, yellow, specific gravity 1.018. Albumin, faint trace, sugar 0, acetone ++, 4 to 6 W.B.C. per high power field, and an occasional hyaline cast.

Preliminary diagnoses were intrauterine pregnancy; intra-abdominal hemorrhage of unknown cause; possible ovarian cyst twisted on a pedicle; possible pedunculated uterine fibroid twisted on a pedicle.

**Operation:** (D.E.E.) Under nitrous oxide, oxygen, and ether anesthesia the abdomen was opened through a suprapubic midline incision. Upon opening the peritoneal cavity, a large amount of blood was encountered. This was removed by suction and collected in a sterile flask, which contained citrate. As much liquid blood and blood clots as possible were removed. It was estimated that this amounted to about 2,000 cubic centimeters. The uterus was enlarged, soft and consistent with a 4 to 5 months' pregnancy. The right tube and ovary were normal. The left tube and ovary were the site of ectopic pregnancy, which had ruptured. There was a large rent, about 5 cm. long, in the tube, from which there was free bleeding. Clamps were applied, and the tube and ovary on the left were removed. Double transfixated catgut ligatures were applied and the clamps removed. The abdomen was closed in layers without draining.

The specimen was examined and found to contain the head of a macerated fetus, about 2.5 cm. in diameter. The remainder of the body was not found.

**Subsequent Course.**—During the operation the patient was given one unit of plasma and 500 c.c. of citrated blood. Following the operation, her condition was relatively good, her blood pressure having been maintained, and her pulse not having become elevated. After she had been returned to her room, 1,000 c.c. of the blood which had been removed from her abdominal cavity was given.

Her postoperative course was uneventful. She had not felt fetal motion. On the tenth postoperative day, a film of the abdomen was taken but there was no evidence of fetal skeleton. This brought up the possibility of the enlargement of the uterus being due to a hydatidiform mole, or to fibroids. The patient was discharged from the hospital fifteen days after operation. An Aschheim-Zondek test at this time was positive. There had been no vaginal bleeding.

Six days later, the patient felt fetal motion strongly, although the fetal heart was not as yet audible.

The remainder of the patient's course was uneventful. Throughout her pregnancy, the size of the fundus seemed to be greater than was reasonably to be expected. It was suspected that the intrauterine pregnancy might be a twin one, but two heads were not palpable, nor were two hearts audible, and on April 3, 1944, a plain film of the abdomen showed only one fetus. The calculated due date was April 22, and on April 26, at 11 P.M., the patient began to have mild uterine contractions. Six hours later, after a relatively easy labor, a 10-pound male infant was delivered from left occiput anterior position. There seemed to be a definite increase in the amount of amniotic fluid, which, together with the large size of the infant, probably accounted for the large size of the uterus.

### Comment

In the series of cases reviewed from the literature by Gemmell and Murray,<sup>5</sup> there were 93 in whom the condition was discovered in the first half of the pregnancy, before abortion of the uterine ovum. Of these, 36 aborted postoperatively, and 32 carried the intrauterine pregnancy to term. After attempting to analyze their data, they conclude that there are no definite criteria on which to base the prognosis of the intrauterine ovum postoperatively, although they have the impression that those patients having a large amount of intraperitoneal blood are more apt to miscarry. Details regarding the corpus luteum in the various case reports are scant, but it is known that not all of the patients in whom it was removed miscarried, and, on the contrary, some in whom it was left did miscarry. No notice of the corpus luteum was made in our case, nor was it mentioned in the pathologic report.

From the size of the macerated fetal skull removed at operation, it would appear that this was an instance of twin pregnancy, and that the circumstances which led to the patient's first hospitalization were concerned either with a threatened abortion of the uterine ovum, or with a beginning rupture of the ectopic pregnancy. We made the mistake opposite to that usually made; i.e., we considered the situation to be an intrauterine pregnancy alone, whereas it appears to be more common to consider that the pregnancy is ectopic alone. The unusual size of the uterus with relation to the menstrual history led us in this direction.

### Summary

Coincidental intrauterine and extrauterine pregnancy is a relatively uncommon complication of pregnancy, dangerous both for the mother and for the intrauterine ovum. A case is reported in which the intrauterine ovum was carried to term.

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## SUPRACERVICAL PREGNANCY FOLLOWING SUPRA-VAGINAL HYSTERECTOMY

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**S**UPRACERVICAL pregnancy following hysterectomy is a very rare occurrence. There are reports of 6 cases of pregnancies following hysterectomies, of which 4 were tubal, 1 extrauterine and 1 in the cul-de-sac posterior to the bladder. Two of these patients died of hemorrhage; two had the pregnancies removed by operation; one had a 7 months' child delivered by laparotomy, and one had a 6 months' child delivered from the cervix. Because of its unusual location, the following case was thought worth while reporting:

Mrs. P., white, aged 34, was seen for the first time by one of us (F. E. S.) on October 5, 1933. She was pregnant. The expected date of delivery was February 27, 1934. Physical examination and Wassermann test were negative. Prenatal course uneventful except for nausea and some vomiting in first 3 months. Delivered (F. E. S.) February 28, 1934, midforceps, because of midpelvic arrest, and median episiotomy. Patient was seen at intervals until 1937, when she was again pregnant. Prenatal course uneventful except for nausea and some vomiting in first three months. Delivered (F. E. S.) spontaneously July 24, 1938. In August, 1939, she complained of bearing down pains in pelvis, short menstrual cycles. On examination "uterus larger and firmer than would be expected. No definite tumor outlined." Irregular bleeding increased and in December, 1939, a curettage was done (F. E. S.). Pathological report: "Glandular hyperplasia with marked hyperplasia of stroma." Following this, the periods were regular and normal.

In August, 1941, she complained of backache. On examination, a fibroid was easily distinguished in fundus. Uterus was slightly enlarged. Pessary was introduced. Backache was relieved.

In January, 1942, patient was told that if she wanted another baby to plan it soon. Patient said she and her husband had decided against another pregnancy.

In April, 1943, uterine fibroid definitely larger. Surgical consultation (M. S.-B.). Hysterectomy advised.

Patient was admitted to Booth Hospital June 5, 1943, and a supracervical hysterectomy was done (M. S.-B.) on June 6. The uterus was amputated at the uteroe cervical junction without removing the tubes and ovaries. The cervical stump was closed with 4 interrupted chromic sutures. The ligated tubes and round ligaments were sutured to the posterior lip of the cervical stump and the vesicle fold was brought over to cover the area. The patient made an uneventful recovery. Following this and until March, 1944, patient was well and had no complaints. She had fairly regular, scanty monthly bleeding. On March 20, 1944, patient was seen by both of us. She had missed one period. She was nauseated, having a few hot flashes and occasional lower abdominal

pains. On examination, cervix seemed well suspended, adnexa negative, no pathologic condition found. Endocrine therapy helped patient's symptoms.

Patient reported a flare-up of nausea and abdominal pain April 12, 1944. Examination at this time showed a softer cervix and immediately above it a small, soft mass. The nausea increased and the picture duplicated that of her two previous pregnancies. On examination, the mass was definitely larger and a diagnosis was made of a supravaginal pregnancy of about 6 weeks. Patient entered the hospital on April 28.

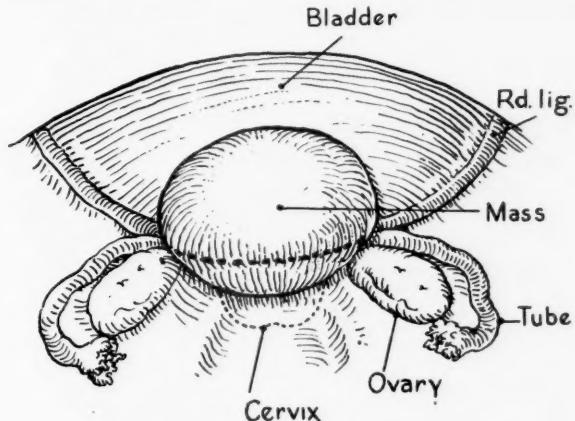


Fig. 1.

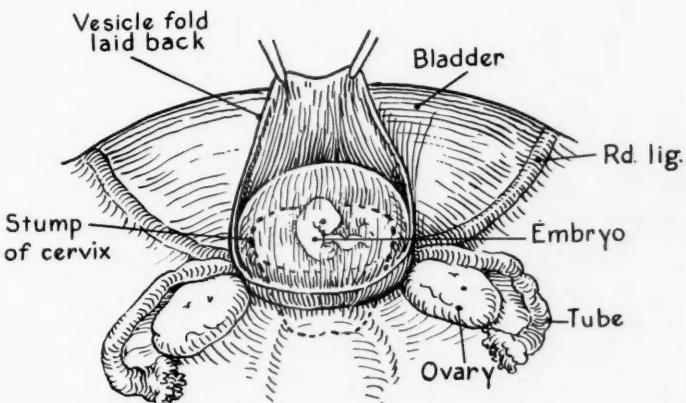


Fig. 2.

On April 29, 1944, an exploratory laparotomy was done. The abdomen was opened through the old midline scar which had become hypertrophied and pigmented. The pelvis was inspected. There were a few adhesions which were freed and the vesicle fold with the round ligaments and tubes was found to have been stretched upward by a mass situated apparently on the cervical stump. (Fig. 1.) The vesicle fold was dissected free and laid back. Beneath the fold, there appeared tissue which resembled placenta, and from this by blunt dissection, a sac of fluid containing a  $6\frac{1}{2}$  weeks' embryo was shelled out intact. (Fig. 2.) As much placental tissue as possible was removed, and the stump

of the cervix closed with chromic sutures. The tubes were both resected and the round ligaments resutured to the posterior lip of the cervix. The vesicle fold was brought down over the stump and ligaments. The wound was closed in layers. The patient made an uneventful recovery, and was discharged on the fourteenth day after operation.

Examination on June 2, showed the wound was well healed, pelvis negative and her general condition excellent.

*Follow-Up Note.*—Patient seen during the month of October, and found to be in good condition.

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## ORTHOSTATIC ALBUMINURIA DEVELOPING LATE IN PREGNANCY\*

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**T**HIS case is reported because first, it presented a trying if not serious diagnostic problem and, second, in a rather extensive and careful perusal of the literature and standard textbooks on obstetrics, no mention is made of the condition other than in the few instances cited here. It is the author's opinion that an occasional case diagnosed as mild pre-eclampsia or "low reserve kidney" of Stander and Peckham, may be in fact nothing more than orthostatic albuminuria developing late in pregnancy. Indeed, it is well known that in the later months of pregnancy, when the gravida assumes the erect posture, there is a tendency toward exaggerated lordosis, and lordosis is believed to be the principal cause of orthostatic albuminuria.

The case reported below might well have been put at strict bed rest or even hospitalized with a resultant clearing of the albumin from the urine. The obstetrician would then have felt that the bed rest plus the usual dietary restriction effected the "cure."

F. Cook and V. E. Lloyd<sup>1</sup> report a case of albuminuria occurring late in pregnancy. Their patient, when put to bed, had no albumin in her urine but, the moment she was allowed up, the albumin recurred. No diagnosis was made, nor were any conclusions drawn from this case. G. W. Theobald,<sup>2</sup> in a very comprehensive article, suggests the possibility of a mechanical albuminuria of pregnancy. He further states: "Albuminuria, *per se*, bears no relationship to the toxemias of pregnancy." However, no specific cases are cited. P. Balard<sup>3</sup> reports the case of a woman who had orthostatic albuminuria from adolescence until the time she became pregnant. During her pregnancy the albuminuria disappeared.

### Case Report

S. A., white, 26 years of age, a private patient, was first seen at my office on April 22, 1941. At that time, she was pregnant for the first time, and her prenatal course was uneventful. Bi-weekly blood pressure determinations and urine examinations were normal. She did have a rather pronounced anemia which was treated with iron per os and liver injections. She was delivered at term of a 5-pound 5-ounce normal female infant, and the postpartum period was without incident. The patient was next seen on August 6, 1943, at which time she was again pregnant. Her last menstrual period was June 13, 1943, and the computed date of confinement was March 20, 1944. The Wassermann test was negative, and the hemoglobin 80 per cent (Sahli). Nevertheless, a ferrous iron was immediately prescribed, but, notwithstanding this, within 2½ months, the patient's hemoglobin had again fallen to 60 per cent (the same as her last pregnancy). The patient's prenatal course was again otherwise uneventful, and she stated that she felt better during this pregnancy than she had in years.

\*Read at a meeting of the Section on Obstetrics and Gynecology of the New York Academy of Medicine, May 23, 1944.

At the onset of her pregnancy, the patient weighed 140 pounds; at the beginning of the ninth calendar month, she weighed 160 pounds. She was seen at the office on February 15, 1944 and a marked trace of albumin was found in the urine; the blood pressure was 115/70. It was felt that this albumin might have been the result of vaginal contamination. On questioning, the patient stated that she had had no headaches, though she had suffered with them frequently prior to the onset of this pregnancy. There was no sign of edema of the face or extremities. A specimen of urine sent to the office three days later contained two-plus albumin, and microscopic examination of the urinary sediment showed an occasional hyaline and finely granular cast, but no red blood cells. This microscopic picture remained unchanged until delivery. Her blood pressure was 120/65, weight 161 pounds, and a specimen taken at that time showed four-plus albumin. There were no subjective complaints nor was there any edema.

She was put on a rest regime and told to eat nothing but small quantities of fruits and vegetables, cooked without salt, and to drink 4 to 6 glasses of milk a day. Four days later, the urine boiled almost solid with albumin, but the patient's blood pressure and weight were unchanged. For the next two days there was no change.

By this time the patient was somewhat disgusted. She stated that she had felt fine until the albumin was found in her urine, but the diet plus the rest regime were "running her down." However, the importance of maintaining this routine was explained and the patient continued to cooperate. She returned to the office three additional times at three-day intervals; each time the urine was loaded with albumin, the blood pressure was 115/60 and her weight remained the same. Subjective symptoms of toxemia and edema were absent. She was then told to do the following:

One hour after retiring, empty her bladder in a bedpan and discard that urine. The following morning she was again to empty her bladder in a bedpan, without getting to her feet, and bring that specimen to the office. When she arrived at the office, she was again asked to void. The two specimens were examined and the one voided early in the morning was found to be albumin-free, whereas the one taken at the office boiled almost solid. This same procedure was repeated on three successive days with the same results.

It was the author's opinion that this was a case of orthostatic albuminuria developing late in pregnancy. Ophthalmologic eye ground studies were reported as perfectly normal. Various laboratory procedures were then carried out. The results were as follows:

#### Blood Count—3/14/44

Hemoglobin—73%  
R.B.C.—3.75 million  
W.B.C.—16,800  
Platelets—190,000  
Myelocytes-Neut.—2%  
Polys, nonsegmented—29%  
Polys, segmented—54%  
Lymphocytes—10%  
Monocytes—5%

#### Blood Chemistry

Glucose—89 mg. %  
Van Slyke Index—41 (Stand-  
ard clearance)  
Urea nitrogen—11.7 mg. %  
Uric acid—1.9 mg. %  
Albumin-Globulin ratio—2.7

#### Fractional Phenolsulfonphthalein Test for Kidney Function

After first 15 minutes	18%	After fourth 15 minutes	8%
After second 15 minutes	22%	After fifth 15 minutes	6%
After third 15 minutes	19%	After sixth 15 minutes	4%

On March 17, the head was found to be fairly well engaged and the patient was told to take two ounces of castor oil. She went into labor at 6 o'clock that evening, and was delivered of a normal female infant, weighing 5 pounds 9 ounces, five hours later. The postpartum course was entirely normal, and urine examination (catheterized), on two separate occasions, revealed neither albumin nor casts. The patient was discharged from the hospital on the thirteenth postpartum day. On four subsequent occasions, covering a period of three weeks, her urine was examined and found to contain neither albumin nor casts.

### Summary

A case of orthostatic albuminuria occurring late in pregnancy is detailed. This diagnosis is probably indisputable, nevertheless, in fairness we may point out the following: The blood count showed a leucocytosis and a shift to the left in the differential; however, this is surely not the blood picture of a toxemia; the Van Slyke index standard clearance is at the lower limits of normal; the fractional phenolsulfonphthalein test shows a delayed excretion, but we may explain this by the fact that the patient was at term, and there is a known hydronephrosis and hydroureter late in pregnancy. Finally, the absence of subjective symptoms, the occurrence of albumin in the urine only on assuming the erect posture, the normal weight gain, the absence of edema of the face or extremities, the repeatedly normal blood pressure readings, the absence of eye ground changes, plus the essentially normal blood findings, all confirm the diagnosis.

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20 EAST 76TH STREET

## **AN UNUSUAL CASE OF ALLERGIC (ANGIONEUROTIC) EDEMA AND OLIGURIA ASSOCIATED WITH PREGNANCY**

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**A**NGIONEUROTIC edema is not uncommon; when extremely marked and associated with pregnancy, it is infrequent and, fortunately, relatively rare. This report is recorded because of the unusual and bizarre complications that may arise during the pregnant state.

Mrs. B. C. presented herself at the office on 10/21/43 some 16 weeks pregnant. From the obstetric point of view, the pregnancy was to all intents and purposes, normal and the pelvis adequate by the usual clinical methods of measurement. She had had one child 3 years previously. The labor lasted 24 hours and terminated in a spontaneous delivery; following the birth of the child, there occurred a retained placenta with a resulting mild postpartum sepsis. Further questioning revealed the fact that the patient, since her last pregnancy, suffered from edema occurring at times on various parts of her body. Because of this recurring edema, she was studied at that time by the Mt. Sinai Diagnostic Clinic and found to show sensitivity to numerous foods and articles. At her first visit to me, it was demonstrated that, although she had a patchy sort of edema of the face, hands, chest, legs and even the abdomen, nevertheless, her blood pressure was 104/60, her weight 148 (just prior to pregnancy, 139), her urine negative for sugar, albumin and microscopically. Since obviously this did not appear to be a toxemia of pregnancy, a tentative diagnosis of angioneurotic edema, generalized, was made. One and one-half grains of thyroid a day were given because of a known minus 18 basal metabolic rate. For the next two months under this regimen and although the edema did not improve, it became no worse. Her blood pressure remained low, the urine was negative, and her weight gain was only 5 pounds. Shortly after this, however, there was a sudden change in the entire picture. Within four weeks, there was a gain of 9 pounds in weight, and the edema became more pronounced and persisted throughout the entire day and night. The blood pressure remained low (90 to 100 systolic and 40 to 60 diastolic), and the urine analysis negative. The patient, now 30 weeks pregnant, noticed that she was passing less and less urine. A carefully measured 24-hour specimen was only 550 c.c., and, although repeated for 1 week continuously, the amount voided remained in the neighborhood of 500 to 600 c.c. in 24 hours, with only one change: an increase in the specific gravity to 1.026 to 1.030. The edema at this time was massive and the patient hardly able to get out of bed. A combination of theobromine-sodium-salicylate gr. 4 and aminophyllin gr. 1½ every 4 hours by mouth was prescribed with the most amazing results. The patient began to void 3,000 to 3,500 c.c. daily for 4 days and then tapered down to 2,000 cubic centimeters. With this, part, but nowhere near all, the edema subsided. As soon as the medication was stopped, the edema increased, and the amount of urine decreased to alarmingly small amounts. Throughout this period,

the fetus seemed to be progressing normally. Obviously, the medication was continued. On March 20, 1944, at 36 to 37 weeks' gestation, the patient developed lower abdominal pain which was assumed to be early and premature labor. Upon admission to Beth Israel Hospital, the pain stopped and, since there was no spotting or bleeding, and the cervix was closed with the membranes intact, she was sent home 18 hours later. No sooner did she arrive home when the pain began again. The pain was more or less continuous in the lower abdomen only, both over the uterus and in the flanks and not associated with nausea, vomiting or external bleeding. The uterus, although tender, was not board-like nor in fact had any rigidity at all. Morphine was required to ease the pain. Fortunately, on 3/22/44, some 48 hours after the pain began, she went into labor spontaneously and was fully dilated in three and one-half hours. The membranes ruptured spontaneously with a gush of frankly bloody amniotic fluid, and a few small dark blood clots. The head descended almost immediately, and a living male infant in good condition was delivered spontaneously. Immediately afterward, there was a gush of fresh and old blood and, by this time, it became increasingly obvious that we were dealing with a partial premature separation of a low implanted placenta. No difficulty was encountered with the placental delivery, and there was no postpartum bleeding. Examination of the placenta revealed no unusual macroscopic abnormalities. For the first 3 days post partum, the patient had no medication and again voided only 18 ounces, or 540 c.c. of urine daily. With the resumption of medication, voluminous amounts were passed again. The baby became excessively jaundiced some 36 hours after birth with no other symptoms, but vitamin K, minims x three times a day, was administered nevertheless. The most curious thing began 56 or so hours post partum: the baby had the same kind of patchy, almost brawny edema of the face, abdomen, legs, etc., that the mother had evidenced. The blood examination was more or less normal with 117 per cent hemoglobin and 5.8 million red blood cells with the usual configuration of white cells. The baby left the hospital 1½ ounces over birth weight with the jaundice almost gone, and the edema still present but less. At no time did the infant have a urinary shut down. The mother left the hospital in good condition with very little edema.

The explanation of the phenomena described might be predicated on what is known about angioneurotic edema. The kidneys shut down, the premature separation of the placenta and the edema which this patient demonstrated are all due to vascular spasm with diminution of blood flow and stasis. As far as the baby is concerned, it must be assumed that either the tendency to angioneurotic edema was inherited or the toxin, if there be one, was transported across the placenta. It is an observed fact that patients with mild allergy who become pregnant seem to lose most of their allergic manifestations; severe allergy or allergy of long standing seems not to be favorably affected by the pregnant state.

## PREGNANCY NEAR TERM WITH PROLAPSE OF UTERUS

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**P**ROLAPSE of the uterus at or near term is rare. Kibel<sup>1</sup> recently reported a case and stated that 203 other cases had been reported in the literature. Complete procidentia at or near term is almost impossible, and the following case was only partial. My first thought was that there must be an abdominal pregnancy pushing the uterus down causing the procidentia.

Mrs. H. I., aged 28 years, gravida vi, para vi, reported for her first prenatal visit on March 16, 1944. Her last menstrual period was on August 21, 1943, and her expected date of confinement was May 28, 1944.

Her past medical history was negative. She had had five pregnancies with the delivery of six living female infants. The fifth pregnancy ended three weeks prematurely with the delivery of a five-pound infant who survived. She had also been admitted with false labor five weeks before term, during the fifth pregnancy. Her fourth pregnancy was twins, each of whom weighed four pounds, five ounces at birth. All of her other pregnancies had been normal, and none of the infants weighed as much as seven pounds at birth.

Physical examination showed a pregnancy of about six to seven months. There were a cystocele and a general relaxation of the pelvic floor. Otherwise, the examination was negative. The urine and blood Wassermann tests were negative. The blood pressure was 120/80.

The patient was next seen April 10, at 10 P.M., when she reported to the hospital with irregular labor pains. She stated that for the past four hours, a mass had been protruding from her vulva. She said that often during the past two weeks when she had done too much work this mass would protrude. She would lie down and gently replace it, and then take a short rest. On the day of admission, she had done the family laundry, and the vulvar mass again presented itself. This time, however, it became larger than before and she was unable to replace it. After three hours' time, she began having uterine pains and decided it was time to report to the hospital.

On admission, abdominal examination revealed a normal pregnancy of about seven months with vertex presentation. The fetal heart was 140 and of good quality. The uterine cervix was protruding through the vulva, and extended for six inches between the thighs. The cervix was swollen, edematous, and measured 2½ inches in diameter at the tip. The tissue mass at the vulva was 3½ inches in diameter. After sterile preparation, the cervix was gently compressed and replaced into the vagina. It returned easily and there was no tendency for it to recur with the patient lying down. The mucous plug was still in the cervix. To determine if there might be an abdominal pregnancy that had pushed the cervix down, I decided to introduce a finger into the cervix. The cervix easily admitted one finger, and the fetal head could be felt in the uterine cavity.

The patient was then given morphine sulfate, gr. ¼, and put to bed. The uterine pains disappeared and did not recur. She was kept flat in

bed for three days, and then allowed to get up. Vaginal examination at this time revealed the cervix to be normal and one finger dilated. The edema had disappeared.

On the fourth day, the patient was allowed to go home. She was told the nature of her condition and was instructed to rest in bed most of the time.

One week after discharge when she was to return for a prenatal visit, she returned in labor. Labor had started at 1 A.M., and was progressing normally. There had been no recurrence of the procidentia during the week at home. She delivered a male infant spontaneously in the L.O.A. position at 11 A.M. after 10 hours of labor. The placenta delivered spontaneously in five minutes by the Duncane mechanism. The infant weighed five pounds and six ounces, and appeared about one month premature. With breast milk it gained rapidly and was allowed to go home at the end of 10 days with the mother. The mother's course in the hospital was absolutely normal.

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## ARRHENOBlastoma OF THE OVARY

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OF THE few ovarian tumors that exert endocrine influence upon the individual, the arrhenoblastoma by far presents the most colorful picture. It is also the rarest of the ovarian tumors, but in most cases the clinical findings are quite definite, and the diagnosis can usually be made preoperatively. To date, there have been approximately 60 such cases reported in medical literature. Long and Ziskind<sup>1</sup> reporting on 98 solid ovarian tumors from the New Orleans Charity Hospital in a ten-year period (1932 to 1941), found one case of arrhenoblastoma. My case was diagnosed during 1943 and it is indeed unusual, considering the rareness of the condition, for two such tumors to be found in the same institution within a period of 12 years. Perhaps as these authors suggest, further study of solid ovarian tumors, that in the past have simply been diagnosed as fibromas, may reveal the presence of an arrhenoblastoma or some other member of the special ovarian tumor group, such as granuloma-cell tumor, theca-cell tumor, Brenner tumor or dysgerminoma.

The four conditions that must always be differentiated are: cortical tumors of the adrenal, pituitary basophilic adenomas, adrenal cell rests of the ovary, and masculinizing luteomas of the ovary. In adrenal tumors, the breasts remain of normal size, and there is marked hirsutism. A tumor sometimes may be felt in the kidney region, and there may be other adrenal symptoms. In basophilic pituitary adenomas, the patients are usually obese and present other symptoms, such as severe headaches, referable to a pituitary lesion. Hirsutism is not a marked feature. Adrenal cell rests may be found sometimes in an ovary, and produce a tumor that exerts a masculinizing influence upon an individual similar to those with an arrhenoblastoma. Such a tumor is usually a highly malignant one, and the differentiation can be made only by microscopic examination. The ovarian masculinizing luteoma is considered by Schiller and Novak<sup>2</sup> to be really a tumor of adrenal tissue in most instances; therefore, a differentiation clinically would be a difficult, if not impossible, problem.

Most authorities report very little masculinization in tumors that are of the well-differentiated type, but this is not always true. The case which I am reporting showed marked masculinization, yet the microscopic picture is that of a well-differentiated type. Konte and Ragins<sup>3</sup> report a case of the intermediate type in a patient aged 47, who six weeks after removal of both ovaries and uterus, showed return of the clitoris to normal size, and complete absence of hair on the chest. Boltuch<sup>4</sup> reported a case of the undifferentiated type in a woman aged 28, who twelve days after removal of the involved ovary, showed a beginning resumption of normal voice, and complete return of menstruation on the twenty-sixth postoperative day, with normal breasts, and disappearance of abnormally placed hair.

### Case Report

The patient (T-43, U.H. No. 81779, N. H., Gyn. Ward C 507), a young colored female, aged 24, was admitted to the hospital on February 20,

1943, with a chief complaint of cessation of menses and pain, and mass in the lower right quadrant.

The present illness dates back to eight years previously, when at the age of 15, she suddenly ceased menstruating. Menarche was at 11 years, with a regular cycle of thirty days, with a period of 3 days. The cessation of menses was sudden, and did not taper off. She went to see a physician, who gave her some medicine, and six months later she menstruated, but has not done so since. The patient noticed that her voice became harsher and deeper, the breasts became smaller, and there was an excessive growth of hair over the body. It was necessary for her to shave daily. She states that she did not lose any sexual urge.

The summer of 1942, she experienced a pain in the right lower quadrant with fever and slight nausea. She consulted a doctor in the country who sent her to Charity Hospital.

Patient was married at the age of twenty, with no pregnancies. The patient has for the last ten years drunk large quantities of water and has passed more than a gallon of urine (by measure) several times at night.

Recently, she has had some blurring of her vision, and frontal and parietal headaches. She suffers from hot flushes.

**Physical Examination.**—Blood pressure 132/100, temperature 98.8° F., pulse 80, respiration 18. There is a thick growth of hair on the upper lip, chin and throat. The thyroid is palpable. A large mass is felt in the lower abdomen measuring 10 by 7 centimeters. The mass is tender. The hair on the abdomen is masculine in distribution. The clitoris was enlarged to the size of the distal phalanx of the little finger. The cervix is infantile in type. The uterus was small and retroverted. The left ovary is prolapsed and enlarged, and a large mass is felt in the right adnexal region.

**Laboratory Findings (2/22/43).**—Red blood count 4,150,000, Hemoglobin 75 per cent, W.B.C. 6,000. Polymorphonuclear leucocytes 60 per cent, lymphocytes 19 per cent, monocytes, 19; eosinophiles 2 per cent. Urine negative on 2/23/43 and 3/4/43. B.M.R. on 2/23/43 was 26, and 2/26/43 11 per cent. X-ray of the skull on 2/23/43, lateral view, showed no evidence of erosion of the sella, abnormal convolutional markings or calcifications.

A preoperative diagnosis of arrhenoblastoma of the right ovary was made, and on February 27, the patient underwent a laparotomy. A supracervical hysterectomy, bilateral salpingo-oophorectomy and appendectomy was done; the left ovary being removed because it contained a tumor and the supracervical portion of the uterus being removed because both ovaries had to be. Her postoperative course was uneventful, and she was discharged on the twelfth postoperative day. Stilbestrol in dosage of 1 mg., three times daily, was started on the fourth postoperative day, and she was advised to continue this after leaving the hospital. However, she did not do this.

**Pathological Report: Gross.** The specimen consists of a uterus, both tubes and ovaries and a small portion of the cervix. The uterus measures 7.5 by 5 by 3 centimeters. The myometrium is 1 cm. in thickness. The endometrial cavity is normal in size, and the endometrium 1 mm. in thickness. On the left, the Fallopian tube is adherent to an ovarian mass measuring 4.5 cm. in diameter. Its external surface is smooth and grayish-white in color. Cut section of this tumor mass reveals a cavity 3 cm. in diameter, which is filled with a soft, yellowish grumous material, and also some black hairs.

The right ovary is composed of a mass 13 cm. in diameter. Its capsule is white and smooth, but scattered, here and there, under the capsule can be seen hemorrhagic areas of varying sizes. The surfaces exposed by cutting show somewhat of a soft heterogeneous surface composed of soft, yellowish areas varying in size from 1 to 4 centimeters. Scattered throughout are also nodular hemorrhagic areas of varying sizes. Both these nodular areas are separated by trabeculations of fibrous tissue. A few small cysts up to 1 cm. in diameter are scattered through the tumor. The right Fallopian tube is firmly adherent to the capsule and stretched.

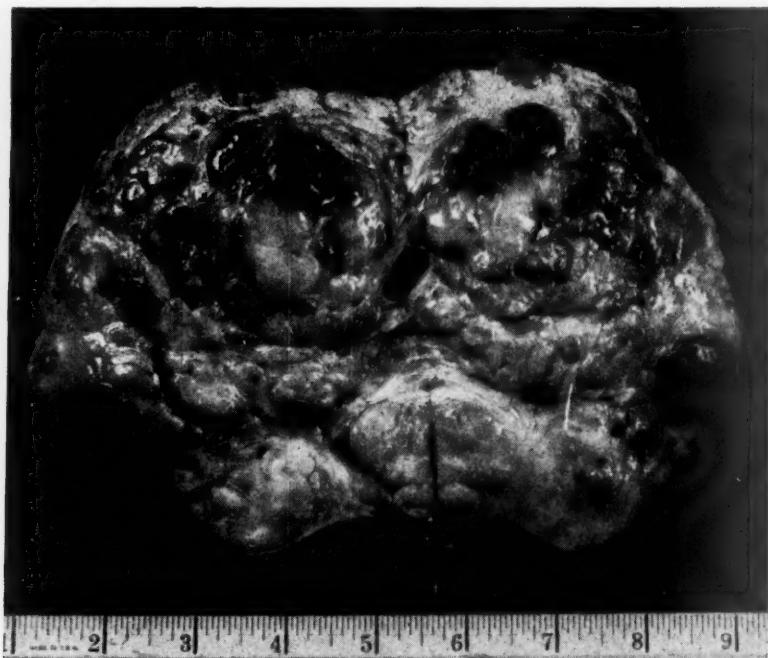


Fig. 1.—Arrhenoblastoma.

*Microscopic.* Section through both the tubes revealed a thickening of the wall with some degree of fibrosis. A number of plasma cells can be seen in the wall. Small areas of glandular formation, composed of mucosal tubal glands, can also be seen buried into the musculature. The membrane is flattened, and fibrosis can be seen in the stalks. The myometrium is normal. The endometrium is atrophic and shows early progestational changes.

The left ovary reveals numerous corpora amylacia. Dense areas of hyalinization are present, in which is embedded, here and there, calcareous material. In one area, groups of xanthomatous cells can be seen. In one area can be seen a cyst wall lined by a flattened epithelium.

The right ovarian tumor consists in the main of tubular-like structures with imperfect lumina. The cells composing these structures have large basally situated nuclei, the cytoplasm of which, more or less, streams into imperfect lumen. The nuclei are vesicular and the chromatin is gathered in clumps. The cytoplasm is eosinophilic and granular. Here and there, gathered in clumps throughout, are small areas of

interstitial cells. The interstitial and supporting tissue is made up of strands of well-formed connective tissue. In certain areas, there is necrosis and hemorrhage. Occasionally, one sees, in small areas, neoplastic cells which have lost their polarity, and are scattered as single or small nests of cells in the interstices of the connective tissue.

The diagnosis was bilateral salpingitis, left ovarian dermoid cyst, atrophic pregestational endometrium and arrhenoblastoma of the right ovary of adult type.

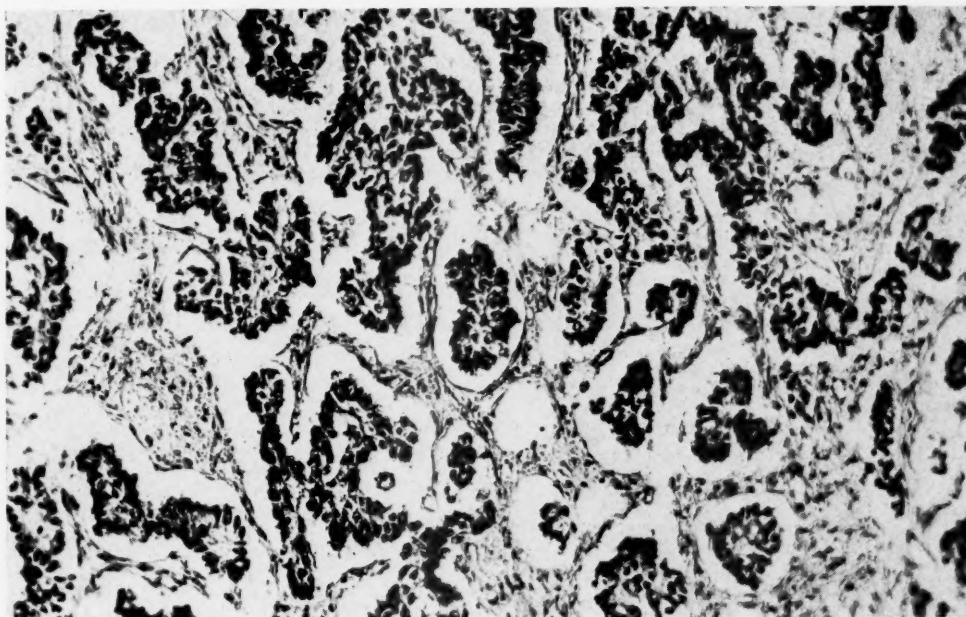


Fig. 2.—Microscopic section of arrhenoblastoma. Shows a characteristic portion of the tumor of the right ovary. Imperfect tubules with basal nuclei are prominent. These are separated by a supporting framework of connective tissue. The structure is that of an adult arrhenoblastoma.

### Summary

Before operation on February 27, 1943:

1. Abrupt cessation of menses at 15.
2. Onset of masculinizing traits at this time (deepening of voice, appearance of hair, a beard, masculine physique, atrophy of breast. Progressive increase in sex desire, hypertrophy of clitoris (all progressive from 15 to time of admission at 24).
3. Had pain in lower abdomen, headaches.
4. Right abdominal mass found.
5. Marked hypertrophy of muscles of shoulders and upper extremities.  
Since leaving hospital:
  1. Hot flushes 3 to 6 daily.
  2. Night sweats.
  3. Decrease in number and intensity of headaches.
  4. Marked increase in size of breasts.
  5. Loss of much hair on abdomen, back, arms and legs. Still has beard, shaves twice a week, not so thick, and does not grow as fast.
  6. Decreased libido,

7. No change in voice.
8. Gain of 22 pounds.
9. Some decrease of clitoris enlargement.
10. Muscles of upper extremity almost same.
11. Chest plate negative for metastatic lesion.

She was again put on stilbestrol in dosages of one mg., three times daily, and advised to continue this drug until seen again. Her general health was excellent, and she seemed quite satisfied with the results obtained following the removal of the pelvic organs.

### Conclusions

A proved case of an arrhenoblastoma of the ovary in a 24-year-old colored female has been reported, with a follow-up nine months after removal of the tumor. Microscopic examination showed it to be of the adult or well-differentiated type. Following its removal, the patient became more feminine, but still retains some of the male characteristics that had developed in her at age 16. She retained her deepened voice, the clitoris remained somewhat larger than normal and the muscles of the upper extremity showed little change. She also reported that she still grew a beard that required shaving, but much less than before surgery. It is hoped that in time, most of these male characteristics will continue to diminish. The finding of an early progestational endometrium was, indeed, interesting and rather difficult to explain. The presence of a dermoid cyst in the opposite ovary offers additional circumstantial evidence in support of the theory of teratomatous origin of the ovarian arrhenoblastoma.

I wish to acknowledge and also to thank Dr. Bjarne Pearson of the Department of Pathology, Tulane University, for his excellent description of the tumor.

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## **REDUCTION OF AN INVERTED UTERUS FOLLOWING INTRAVAGINAL PACKING**

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(From the *Obstetrical Service of Morrisania City Hospital*)

**T**HIS case of inversion of a puerperal uterus is presented for its unusual feature—complete reduction following intravaginal packing. One other similar case was found, described by Harer and Sharkey.<sup>1</sup> In their case, the condition was diagnosed as a pedunculated fibroid, and a laparotomy was done with hysterectomy. When the peritoneal cavity was opened, it was found that the uterus, which had actually been inverted, had been replaced in the process of packing the vagina before operation. On examination of the excised uterus, no fibroid was found.

### **Case Report**

Our patient was a 23-year-old white female, para ii, gravida ii, who was admitted to the Morrisania City Hospital at 3:30 A.M. on October 3, 1943, with vaginal bleeding as her chief complaint.

Her first delivery had been spontaneous and uneventful. The past medical and surgical histories were essentially negative.

During her present pregnancy, she had received prenatal care from a midwife. She had a normal spontaneous delivery of a full-term 6½-pound female baby at home about 8:45 P.M. on October 2, 1943. About 45 minutes after the delivery of the baby, a local physician was called by the midwife because she noticed a mass protruding from the vagina with the placenta attached. The physician, on arrival, found the uterus inverted with the placenta attached lying in a wash basin. The woman's condition at this time was good. He manually removed the placenta from the uterus, and then pushed the fundus into the vagina. He thought that he had completely replaced the uterus. At 2:15 A.M., 4½ hours following delivery of the baby, the physician was recalled because the patient was bleeding. He found her in shock and bleeding. Her blood pressure was 70/40 and hemoglobin 40 per cent (Sahli). She was given an infusion of 1,000 c.c. of 5 per cent glucose, 1 c.c. of adrenalin and 1 c.c. of obstetrical pituitrin before being sent to the hospital.

Examination on admission revealed the patient in moderate shock, and bleeding moderately. Her pulse was 140 and blood pressure 80/40. Since the diagnosis of inversion was not made by the resident, he gave her ½ grain of ergotrate and 1 c.c. of obstetrical pituitrin intramuscularly soon after admission. This was followed by a transfusion of 500 c.c. of bank blood. At 5:30 A.M. an abdominal examination revealed the fundus to be firm, 4 fingers below the umbilicus, and although no definite cupping was palpated, the fundus was not well rounded. She lost about 500 c.c. of blood from the time of admission to the time she was taken to the operating room (2¾ hours). Her general condition remained about the same. At 6:15 A.M. or 9¼ hours post partum, the

patient was anesthetized in order to make a definite diagnosis and to check the bleeding. Examination disclosed an inversion of the uterus with about 3 inches of the firm fundus below the cervix. At this time, while the abdomen was well relaxed, bimanual examination revealed a definite cupping of the fundus. Simple palpation of the inverted uterus caused a marked increase in vaginal bleeding. The vagina was then packed with 25 yards of iodoform gauze, especially placed against the inverted uterus to control bleeding. No difficulty was found in inserting this large amount of gauze. The patient's condition remained about the same during this manipulation as noted by the blood pressure reading of 60/30 before anesthesia was begun, and 70/40 at the end of the procedure. Packing of the vagina checked the bleeding. The patient's condition improved almost immediately. Abdominal examination 4 hours later, disclosed the uterus slightly cupped and displaced under the left costal border by the pack in the vagina. A second examination 12 hours after the packing, revealed a well-rounded fundus with the inversion completely reduced (Fig. 1). She was given two more

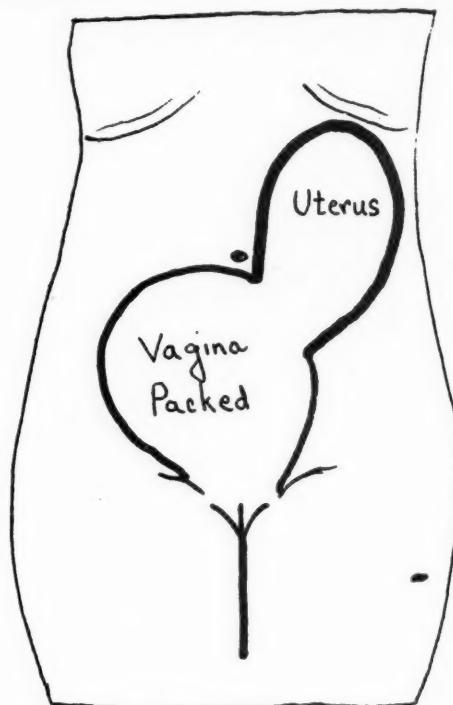


Fig. 1.

500 c.c. transfusions of bank blood and placed on sulfathiazole therapy for five days. Fifty-six hours after the packing, the vaginal iodoform gauze was removed under a general anesthesia. The inversion was found completely reduced, with the fundus convex in contour. Two fingers were introduced into the uterine cavity to be sure that a partial inversion above the cervix did not remain. The distended vagina disappeared following removal of the packing. The patient made an uneventful recovery, except for a rise in temperature to 102° F. just before she

signed herself out contrary to advise on the ninth day post partum. The uterus was well involuted, and there was no evidence of uterine prolapse. The family physician reported that her temperature came down to normal on the second day at home.

### Discussion

Since nothing is known about the conduct of the third stage in this particular patient, it would be very difficult to state definitely the cause of the inversion of the uterus.

The treatment of this patient was conservative because she was in shock, and because slight vaginal manipulation caused a marked increase in the vaginal bleeding. Of late,<sup>1, 2</sup> there has been an increased trend to make no attempt to replace an inverted uterus when the patient is in shock. The mortality figures have been found to be lower, if reduction of the inversion either by taxis or operative means is attempted after the patient has responded to shock therapy.

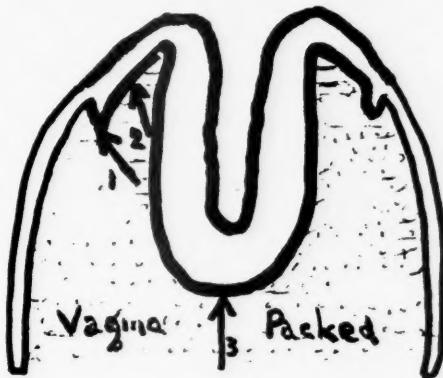


Fig. 2.

Although the rounded fundus was not palpated until 12 hours after the vagina was packed, the uterine replacement probably began during and as a result of the packing. The cessation of the vaginal bleeding, and the immediate and marked improvement in the patient's general condition following the packing are in favor of this opinion. The possible explanation of how the packing reduced the inversion may be noted in Fig. 2. The overdistention of the vaginal vault with packing caused the constricting cervix (arrow 1) to dilate and, therefore, removed the ring gripping the fundus. The dilatation of the constricting ring is the most important step in the reduction of an inverted uterus by taxis, also the packing caused pressure against the uterine wall just above the cervix (arrow 2). This technique corresponds to the procedure used in manual reduction of this condition. Finally, pressure exerted by the packing against the fundus further influenced the replacement of this organ (arrow 3).

The authors would like to suggest that where vaginal packing is indicated in the treatment of an inverted uterus, a large amount of packing be employed. Since this condition is very rare and an obstetrician does not encounter more than a few cases during his entire experience, it would be very difficult for any individual investigator to evaluate this form of treatment. However, if success in similar cases were to be ob-

tained by others, the use of a large amount of intravaginal packing would emerge as another form of treatment of a very grave complication in obstetrics.

The authors wish to acknowledge the very helpful assistance of Dr. Milton J. Goodfriend in the preparation of this paper.

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1749 GRAND CONCOURSE

1882 GRAND CONCOURSE

# Department of Statistics

## ABDOMINAL CESAREAN SECTION AT THE CLEVELAND MATERNITY HOSPITAL

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**T**HIS report deals with the obstetric cases delivered by abdominal cesarean section from the years 1931 to 1941. It comprises an analysis of 1,317 such operations, thus permitting a rather thorough study of certain phases of the subject. The cases included are from both the staff and private services.

*Incidence.*—A true picture of the incidence of abdominal cesarean section on our service is probably not strictly obtainable. Due to the character of the staff, many women in need of section are referred directly to the maternity division for this operation by physicians who do not have privileges allowing them to deliver their normal material here.

The staff service is a part of the maternity district obstetric service. Normal multiparas are delivered in their homes. Primiparous patients and operative cases are cared for at Maternity Hospital or on the obstetric service of Cleveland City Hospital, both of which are under the direction of Dr. Arthur H. Bill and the Western Reserve University School of Medicine.

It is necessary, then, to include the figures from all of these services to obtain a true section incidence (see Table I). This figure is further influenced by the fact that many cases in need of operative delivery are referred directly to City Hospital by general practitioners doing home deliveries among the financially poorer groups of our city.

TABLE I. TOTAL DELIVERIES AND CESAREAN SECTIONS 1931 TO 1941

	DELIVERIES	SECTIONS
Cleveland City Hospital	5,429	299
Maternity Hospital—Private	12,683	776
Maternity Hospital—Staff	9,592	667
Maternity District	19,717	

We have performed 776 private and 668 staff sections at Maternity Hospital, and another 299 at Cleveland City Hospital during this period. Our incidence is 1,743 sections in 58,830 deliveries at Maternity Hospital, on the Maternity home delivery service and at Cleveland City Hospital. The incidence is therefore, 2.9 per cent. The incidence among cases delivered exclusively at Maternity Hospital is 1,444 sections in 23,396 deliveries or 6.1 per cent. The private incidence is 6.0 per cent while that of the staff service is 6.3 per cent. We have abstracted 1,317 of these cases.

*Type of Patient.*—This series of 1,317 cases contained 596 staff patients, and 721 private patients. Most of the private patients were white and almost all of the colored patients were found upon the staff service. There were 1,043 white and 274 colored patients. The colored percentage is up paralleling that of the sections themselves—there being 16 colored sections in 1932, and 53 in 1941.

*Mortality and Morbidity.*—There were 24 maternal deaths in the series. This is a mortality rate of 1.7 per cent. The causes of death are listed in Table II. The mortality varied with the type of section as follows: laparotrachelotomy 0.9 per cent, classical 2.6 per cent, Porro 6.1 per cent and extraperitoneal no deaths. The private mortality was 0.5 per cent while that of the staff service amounted to 3.3 per cent.

TABLE II. CAUSES OF MATERNAL DEATH FOLLOWING CESAREAN SECTION

	CASES
Bronchopneumonia	9
Postoperative shock (eclamptic)	6
Pulmonary embolism	2
Postoperative shock (separation)	1
Generalized septicemia	1
Acute cardiae dilatation	1
Postpartum hemorrhage	1
Rheumatic heart disease (failure)	1
Peritonitis	1
Chronic pyelonephritis	1

Morbidity, figured as temperature of 38.0° or over for two or more consecutive days, was found in 594 cases or 45 per cent. This morbidity will be further analyzed later in this paper. The staff morbidity was 54 per cent as contrasted with the private morbidity of 37 per cent. The morbidity among white patients was 41 per cent, while that of the colored group amounted to 60 per cent.

*Indications for Section.*—The indications for section will be found tabulated in Table III.

TABLE III. INDICATIONS FOR ABDOMINAL CESAREAN SECTION

	CASES	PER CENT
Repeat section	404	30.1
Small measurements, etc.	354	26.8
Placenta previa	120	9.1
Premature separation	102	7.7
Toxemia	101	7.6
Cervical dystocia	64	4.8
Medical indications	59	4.4
Pelvic tumor	38	2.8
Unclassified	70	5.3

*Types of Section Done.*—These 1,317 sections were divided as follows: classical 40 per cent, laparotrachelotomy 55 per cent, Porro 3 per cent and extraperitoneal 1 per cent. Among the classical sections, there were 100 high and 430 low sections. The laparotrachelotomies were divided as follows: transverse 702, and vertical 23. Eleven of the classical sections and four of the laparotrachelotomies were followed by hysterectomy.

Our morbidity declined about 20 per cent between the years 1934 and 1941. During this time, the percentage of laparotrachelotomies was

more than doubled. In general, then, it may be said that morbidity declined as the low-flap operation was employed more often.

*What Procedures Affect the Morbidity.*—It seemed interesting to attempt to find out what affected the morbidity rate in abdominal cesarean section. Several possible factors were, therefore, investigated. First of all, what was the effect of extra surgery? Further surgical procedures such as tubal resection, myomectomy, cornual resection, etc., were done in 253 cases. Of these, 39 per cent showed a morbidity. This is somewhat less than the total morbidity.

In 1,230 cases the membranes were intact, and in 90 they were ruptured. The cases with ruptured membranes showed a 60 per cent morbidity as contrasted with 45 per cent morbidity for the entire series.

The cervix was not dilated in 988 cases, and 38 per cent of these showed a morbidity. In the cases showing one to three fingers' dilatation at the time of section, 56 per cent showed a postoperative morbidity, while 66 per cent of those over three fingers dilated were morbid.

In the cases of premature separation of the placenta, the morbidity was 59 per cent, while the group sectioned for placenta previa ran a 51 per cent morbidity.

The effect of anemia is shown by the fact that the cases with a hemoglobin of 60 per cent or less, had a morbidity of 75 per cent. The cases with a hemoglobin of between 60 and 75 per cent showed a morbidity of 57 per cent, while with a rise of the hemoglobin to 75 per cent or over, the morbidity fell to 47 per cent. These figures would be even more striking had hemoglobin determinations been carried out routinely on the private service rather than just on those patients whose condition specifically warranted it.

Morbidity increased with the number of rectal examinations. Morbidity due to some form of pelvic infection appeared in 1.9 per cent of those in whom no rectal examinations were done, while it increased to 13 per cent in those who had three or more rectal examinations. Pre-operative vaginal examinations resulted in a morbidity due to pelvic infections in 20 per cent of the cases. It must be remembered in evaluating these data, that rectal and vaginal examinations are done most frequently in those cases where a potential morbidity already exists.

Those cases which had a trial of labor showed a morbidity of 54 per cent, while there was a morbidity of only 41 per cent among the elective sections.

The effect of operating anesthetic time is shown in Tables IV and V. In general, the longer the operating or anesthetic time, the greater the morbidity.

TABLE IV. TIME OF ANESTHESIA AND MORBIDITY

MINUTES	CASES	MORBID CASES	PER CENT MORBIDITY
20 to 30	45	8	17
30 to 40	145	64	44
40 to 50	226	98	43
50 to 60	420	188	42
60 to 90	396	182	46
Over 90	57	33	57

Those cases requiring postoperative catheterization showed a morbidity due to genitourinary tract causes of 15 per cent. This corresponds closely to the figure of 13 per cent genitourinary morbidity in

TABLE V. TIME OF OPERATION AND MORBIDITY

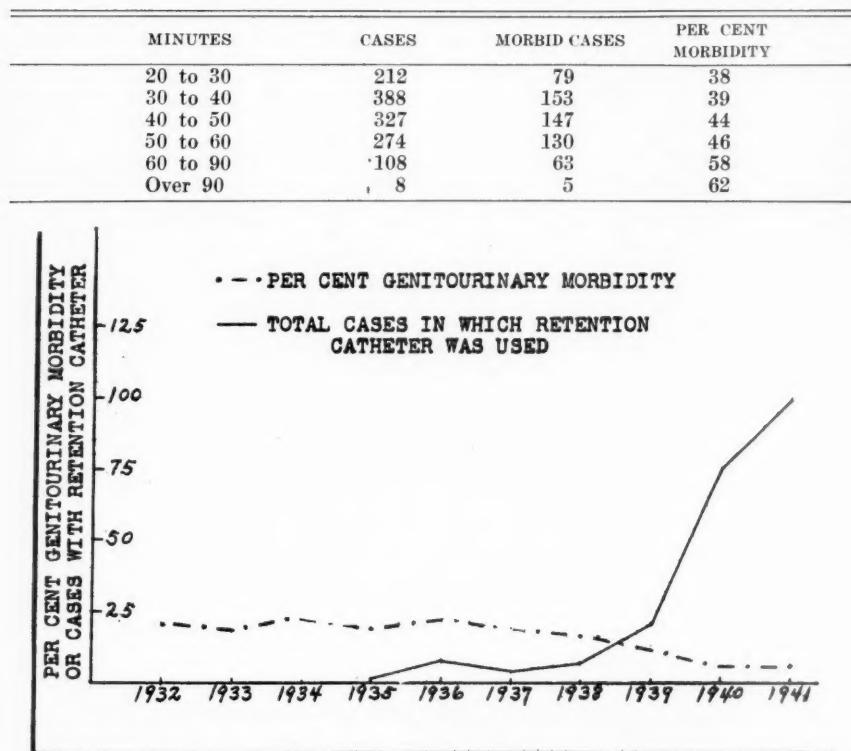


Fig. 1.—The effect of the use of the retention catheter on the urinary morbidity.

the whole series, and also to that obtained in a series of cases including all types of deliveries recently studied here. Those cases in which a postoperative retention catheter was used, however, showed a genitourinary morbidity of only 4 per cent. In Fig. 1 the effect of the use of the retention catheter is shown graphically.

Laparotrachelotomies required catheterization 31 per cent of the time, classical sections 26 per cent. Cases in which a retention catheter was used are not included in these figures.

The causes of morbidity are listed in Table VI.

TABLE VI. CAUSES OF MORBIDITY

	CASES	PER CENT
Genitourinary tract	173	13
Abdominal wound infection	93	6
Pelvic infections	73	5
Operative reaction	67	5
Respiratory tract	44	3
Retained lochia	20	1
Phlebitis	16	1
Unknown	89	6
Unclassified	50	3

*Other Considerations.*—Slightly more than half of these cases of small measurements and cephalopelvic disproportion were allowed to

have a trial of labor. The balance was operated upon as elective sections. Laparotrachelotomy was used twice as often upon patients already in labor, while the low-flap type of operation and classical section were done equally as often upon patients not in labor.

The most popular type of premedication was amyntal and atropine, while amyntal alone was a close second. A large number of the cases in labor was already started upon morphine and scopolamine routine at the time of section.

### Summary

A series of 1,317 cases of abdominal cesarean section operated upon between the years 1932 and 1941 has been studied. This study included mortality and morbidity, the causes of morbidity and other considerations.

## Correspondence

### Cesarean Section

To the Editor:

The report by Rosensohn, Kushner and Wahrsinger titled "Cesarean Section at the Bronx Hospital" (AMERICAN JOURNAL OF OBSTETRICS AND GYNECOLOGY, August, 1944, pp. 274-277) prompts this communication.

There are several altogether remarkable facets in their report, the most outstanding being the obvious and total failure of an artificial obstetric oligarchy in its attempt at reducing mortality following cesarean section. Stimulated, apparently, by the Academy of Medicine report on maternal mortality and by figures obtained from the Hospital Information Bureau, the authorities at the hospital set out to reduce the incidence and mortality of cesarean section. This was to be done by limiting the number of men privileged to do the operation and by consultation which, "did not need to be direct." If such consultation bears any resemblance to what the authors described as "telephone permission" in an emergency, then it probably is as valueless as telephone consultation. Obstetric consultation by telephone is invalid and futile. The consultant must accept the interpretation of signs, symptoms and a dynamic situation as verbally conveyed to him by the man on the scene who may or may not be accurate, and who may or may not be ignorant. The consultant himself, awakened from a sound sleep or disturbed at his own work can scarcely possess the intellectual clarity required to analyze a complex situation of which his knowledge is merely a verbal communication. Telephone consultation may have a certain "beauty" in a hospital record. Its practical value is *nil*. Obstetrics is still a clinical art.

The plan of the Bronx Hospital (and there is nothing in the report to indicate success or failure in the reduction of incidence) was dangerous from at least one viewpoint. It fixed responsibility for the results of cesarean section squarely upon the shoulders of a little group of obstetricians and gynecologists. From the day the plan was instituted, they could no longer lay the blame for section mortalities at the thresholds of, "surgeons, dermatologists, nose and throat specialists, and orthopedists." (And one is forced to wonder why obstetricians eternally insist that surgeons cannot perform cesarean section. What obstetrician possesses the technical skill or the familiarity with the abdomen as a surgical field possessed by the average surgeon?) Having fixed responsibility, presumably upon qualified obstetricians, at the end of a ten-year period there is reported a maternal mortality of 3.2 per cent. Is this remarkable? Is this the fruit of noble experiment? Is it sufficiently superior to what the, "surgeons, dermatologists, nose and throat specialists and orthopedists" might have done? Would such men (it is incredible that their minds are as rigid as obstetric minds) in a time when the whole obstetric literature has fairly screamed the infinite superiority of the low segment sections have done 255 classical sections out of a total of 494? Certainly obstetricians might have set a better example. In progressive action and thought classical section would be limited to 5 cases in 494 and those would be in the rare instances in which the operator is unable to reach the lower segment because of intra-abdominal adhesions or where he chooses to avoid the lower segment because of a low-lying placenta. And even this latter is no valid excuse for the employment of an inferior and outmoded technique.

Citing McLane and Kuder, the authors venture a discussion of the problem of vaginal delivery in pregnancies subsequent to cesarean section. "These studies would indicate that the fact that a cesarean had been performed at one time does not preclude the possibility of a vaginal delivery in a subsequent pregnancy but the fear of a rupture of the uterus must be kept constantly in mind, and the patients watched with utmost care during their pregnancy and labor." Again, "Also, in cases of former cesarean section, the obstetrician may have the courage to permit vaginal delivery . . ." The hackneyed, "once a section, always a section" is no axiom. Even those who hold it as such do not maintain that one section precludes subsequent vaginal delivery. The expression is more a colloquialism which handily explains a factual situation; it means that the possibility of rupture of the uterine scar in labor must be reckoned with. Four in one hundred classical scars rupture.

One in four hundred lower segment scars ruptures. To permit labor is a gamble. There is no question that the odds greatly favor the patient but the element of chance still exists. Watching patients "with utmost care" is an excellent brand of nonsense since the only thing to watch for is the actual rupture of the uterus. The diagnosis of impending rupture is a great rarity. If, under exquisite observation, the rupture occurs in a well-equipped maternity where, within a few minutes the operator can open the abdomen and repair the damage, then disaster may be averted. If the rupture occurs with the patient at home, then rupture is synonymous with death. Counter to the crippling fear of uterine rupture is the elective section two weeks before term.

In the management of the pregnancy and labor subsequent to section, it is not the obstetrician who must be courageous. It takes courage to be the patient. The obstetrician risks little; "bubble reputation," the annoyance of explaining mortality at a staff conference and the few hours of sleep stolen, perhaps, by a troubled conscience. *The patient risks life.* It is not for the obstetrician to dictate management on the basis of academic or didactic reason or the statistic experience in fanciful obstetric writings. It is his duty to explain adequately to his patient and her responsible relatives the problem of scar rupture and to permit them freely to make the choice of procedure. How many patients will risk their lives over the questionable integrity of an unseen scar? How many patients will accept even the one chance in four hundred? Is it the happy sound of the words "watched with utmost care" that accounts for their use? Why are we not told what to watch for? What is there to watch for? What is there in prenatal care which predicts the character of fibrous tissue in the uterine scar? What is there to predict the reaction of such tissue under the stress of powerful myometrial contraction?

On page 277 the authors venture this: "the cesarean operation is not to be regarded as a panacea for all types of labor . . ." What is this creation? What *obstetrician* has ever maintained the preposterous proposition that section is a panacea? What obstetrician has ever denied the risk and mortality attached to section? But there are obstetricians who know that the mortality of *elective lower segment section* is less than 1 per cent, and that the classical section was an excellent procedure . . . in 1882.

"The striking features of this report from the Bronx Hospital are first, the high maternal and fetal mortality, and second, the low incidence of the operation." But one must note that the incidence of section in private cases is at least double that in ward cases. Does this arouse curiosity? There need be no searching inquiry. The plain fact is that plans of management may be freely applied to ward cases (and daily they are applied and in maternities that would warrant the roaring applause of conservatism) which the obstetrician would never dare inflict upon his private cases.

Whether or not low incidence of section is salutary is a moot point. To deliberately set out to reduce section incidence is a procedure bearing unpleasant implications. The immediate question would naturally be, "What was going on before the crusade began?" Is it possible that concentration on a superior technique might make for a happier statistic picture regardless of incidence? Is it possible that obligatory consultation (?) is a form of meddlesome midwifery? Is a major weapon in the obstetric armamentarium such an evil that the energies of a staff must be directed toward limiting its use? Of what value is the opinion of the consultant whose avowed purpose is a reduction of the incidence of the operation? Reduction of incidence being the goal then the first thought of the consultant, if he holds to his conviction, will be, "How can I avoid section?" rather than, "Is section indicated?" Often enough, this thought alone will mean long tests of labor, bagging placenta previa and risking the priceless babies of elderly primigravida. It will mean too, that cases will come to section after the incomparable values of the elective period are lost.

"We feel that the incidence of cesarean section can still further be reduced." In the face of the reported mortality, the facetious might well produce a very obvious retort to such a statement. In another vein, it is no impertinence to ask, where resides the obstetric worth of the original plan? Where is there wonder in it?

FRED A. KASSEBOHM, M.D., F.A.C.S.  
MILTON J. SCHREIBER, M.D., F.A.C.S.

NEW YORK, N. Y.  
AUGUST 26, 1944

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MILTON J. SCHREIBER, M.D., F.A.C.S.

NEW YORK, N. Y.  
AUGUST 26, 1944

### The Use of the South African Frog Pregnancy Test

To the Editor:

Our attention has been drawn to the increasing publicity given in the lay as well as the scientific press in the United States to the use of the South African frog (*Xenopus laevis*) as a test for pregnancy.

In all these recent communications, there has been no adequate reference to our original report published in October, 1933, in the *Proceedings of the Royal Society of South Africa*.

In the interests of accuracy, we feel it necessary to point out that this test is not being described for the first time, as it is already nearly 11 years old.

Because we feel sure that our American colleagues who are using the frog test have no desire to create confusion about the priority and authorship of this test, we have felt it necessary to draw attention to the correct citation of the original reference.

The interested reader will find subsequent references in: *Nature* 133: 762, 1934; *South African M. J.* 9: 202, 1935, i.e., some 3 years before Elkan first used the test in England, and about 7 or 8 years before Weisman et al. first used the test in America.

The most recent review of the test, summarizing 10 years' experience in this field, will be found in: *Clinical Proceedings* 3: 186, 1944.

H. A. SHAPIRO.

H. ZWARENSTEIN.

CAPE TOWN, SOUTH AFRICA,  
AUGUST 17, 1944.

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To the Editor:

Several years ago a subcommittee of the American Committee on Maternal Welfare succeeded in classifying toxemias of pregnancy. Hyperemesis gravidarum and acute yellow atrophy of the liver were included, although most of the committee believed that the term of "toxemia" should be restricted to those patients having hypertension, edema or proteinuria. This classification has been accepted by most clinics in the United States.

If patients are adequately followed during pregnancy and for six months after delivery, the correct diagnosis can be made in most instances. In a recent study of 348 patients, who had a toxemia in the first pregnancy on our service, and had a subsequent delivery on our service, the diagnosis of hypertensive disease was incorrect in 8 per cent since the following pregnancy was normal. Presumably, an incorrect diagnosis was made in 21 per cent because these patients were diagnosed pre-eclampsia in the first pregnancy and had a recurrence of toxemia in the next. It is possible that they did have pre-eclampsia, or that they had a combination of pre-eclampsia and hypertensive disease.

Dr. Titus has recently suggested another classification claiming that the previous one was at fault. (June, 1944, issue, page 817.) I believe a longer use of the generally accepted classification, together with a longer follow-up, will demonstrate that the classification is a good one providing it is restricted as described above.

WILLIAM J. DIECKMANN, M.D.

CHICAGO, ILL.  
SEPTEMBER 27, 1944.

# Department of Reviews and Abstracts

## Selected Abstracts

### Gynecologic Operations

**De Moraes, A.: Vaginal Hysterectomy After the Menopause for Nonmalignant Conditions,** An. brasil. de ginec. 8: 209-217, 1943.

The author reports a series of vaginal hysterectomies performed during the menopause and afterward for nonmalignant conditions. The majority of women had abnormal uterine bleeding. In most of the cases, disturbances were found, chiefly prolapse of the uterus, cervical erosions, chronic cervicitis, chronic endometritis, endometrial hyperplasia and fibroids. The author believes that vaginal hysterectomy, done under local anesthesia, which is the routine in his clinic, is indicated when these abnormalities are found in a functionless uterus. The reason is that these pathologic conditions are potentially malignant. The operation is therefore prophylactic treatment against cancer.

J. P. GREENHILL.

**Fretes, F. R.: Treatment of Prolapse of the Uterus by the Halban Operation,** An. Inst. de Mat. y Asist. Soc. 4: 131-147, 1942.

After reviewing various operations for prolapse of the uterus such as the Neugebauer, Le Fort, Wertheim-Schauta, Watkins, Kahr, Donald, etc., the author expresses his preference for the Fothergill and Halban operations. Among 52 cases of prolapse treated by the Halban operation, there were no deaths and only insignificant complications. The author considers this operation to be simple, rational and anatomic, and one which can be used in any degree of prolapse.

J. P. GREENHILL.

**De Vasconcellos, E. P.: Some Considerations of Prolapse of the Uterus,** An. brasil. de ginec. 8: 197-208, 1943.

During the last five years 216 women were admitted to the author's gynecologic clinic and of this number 55 had prolapse of the uterus, an incidence of 2.54 per cent. Of the 55 women 16 had first degree, 16 had second degree and 23 had third degree prolapse. The most frequent operations performed among the 45 women were the Halban (15 times), total vaginal hysterectomy (11 times), and the Fothergill operation (8 times). General anesthesia was used 17 times, local anesthesia was used 26 times, and spinal anesthesia twice. There were 4 recurrences in this series of cases. The author favors the Mayo vaginal hysterectomy in postmenopausal women.

J. P. GREENHILL.

**Fox, E. A.: Implantation of Endometrium as Complement to Hysterectomy for Uterine Myomas,** Obst. y ginec. Latino-Am. 1: 561-567, 1943.

In order to maintain the functional relationship between the uterus and the ovaries the author implants a large piece of endometrium. He used this procedure in 16 cases. The technique is as follows: after removing the fibroid uterus, a piece

of endometrium about 2 cm. wide is stripped from the uterine fundus and placed directly on the cervical incision. Special attention is paid to inserting the endometrial flap over the internal os. The endometrial tissue is sewed in place by interrupted catgut sutures and then the wound is peritonealized as usual. The results are encouraging. Menstruation, though not profuse, reappeared sooner or later and persisted in all the women. Symptoms of the menopause appeared only in 3 patients.

J. P. GREENHILL.

**Meigs, Joe Vincent:** *Carcinoma of the Cervix—The Wertheim Operation*, Surg., Gynee. & Obst. 78: 195, Feb., 1944.

Forty-seven cases of carcinoma of the cervix were treated by Wertheim operation plus Taussig dissection of the pelvic lymph nodes with an immediate operative mortality of 0 per cent. Seventeen per cent of these showed lymph node involvement, and 6 of the patients had received treatment elsewhere, the carcinoma having recurred. Insufficient time elapsed for any conclusion to be drawn as to the comparative effectiveness of the method of treatment. It is the author's belief, however, that this method of treatment will give better end results than the present methods of irradiation. Urethral injury is the greatest drawback to the operative procedure.

L. M. HELLMAN, LT. (M.C.) USNR.

### Newborn

**McCall, A. J., Race, R. R., and Taylor, G. L.:** *Rhesus Antibody in Rh-Positive Mother Causing Hemolytic Disease of Newborn Infant*, Lancet 246: 214, 1944.

The authors describe a case of hemolytic disease of the newborn infant where the mother was Rh-positive and had in her serum an antibody similar to, but not identical with, anti-Rh such as was first described by Levine, et al. The writers term their serum St. It has been found to react with blood of 80 per cent of people including all the Rh-negatives, all the heterozygotes (Rhrh) and some of the homozygous Rh-positives (RhRh). By using St and other forms of anti-Rh sera, it has proved possible to determine serologically the genotype of about 80 per cent of people.

The authors present an interesting account of the family history and blood groups in the three sons and parents.

The article is valuable original source data for interesting readers on the problems of heterospecific serum and blood factor differences of pregnancy as correlated to causes of fetal death. In this case the infant was saved by two transfusions from one of the St-negative group-O donors.

CLAIR E. FOLSOME.

**Park, L. M.:** *Large Twins*, Lancet 246: 118, 1944.

Park reports an unusual obstetrical case. The patient, aged 30, para iv, gravida vi, was delivered by classical cesarean section of a set of large twins. The combined weight of the twins was 19 pounds, 2 ounces (8,705 Gm.), the individual weights being 10 pounds, 14 ounces (4,956 Gm.) and 8 pounds, 4 ounces (3,749 Gm.).

The classical section was performed sixteen hours after premature rupture of the membranes, before the onset of labor. Previous roentgenographic study revealed the fetuses lying longitudinally, a breech and a cephalic presentation respectively. The placental weights totaled 3 pounds, 11 ounces; or 2 pounds, 2 ounces, and 1 pound, 9 ounces respectively. The patient experienced excessive post-partum bleeding which required a blood transfusion. Otherwise the convalescence of the mother was uneventful.

A literature search by Park suggests that the larger of these twins is the heavier so far credibly reported.

CLAIR E. FOLSOME.

**Darke, Roy A.: Late Effects of Severe Asphyxia Neonatorum, J. Pediat. 24: 148, 1944.**

Asphyxia neonatorum is a clinical term commonly used to designate the manifestations of anoxia which results from obstruction to placental or fetal circulation, obstruction to fetal respiratory passages, narcosis, prematurity, abnormal delivery trauma, maternal anemia, maternal fever, rapid labor, instrumental delivery, long second-stage labor or premature rupture of membranes.

The author reviewed 25,261 deliveries (New York Hospital, 13,740; University of Pennsylvania Hospital, 11,521). The ages of nineteen of the asphyxiated children at the time of the follow-up examination varied from 2 years and 5 months, to 11 years and 8 months. A parent or sibling of each asphyxiated child was examined to form the control group. The author shows that a statistically significant difference in mental status exists between a group of children severely asphyxiated and apneic at birth and a control group consisting of their siblings or parents.

JAMES P. MARR.

### Pregnancy. Complications

**Perez, M. L.: The Etiology and Pathology of Some Spontaneous Ruptures of the Uterus in Pregnancy, Obst. y ginec. Latino-Am. 1: 509-524, 1943.**

The author is not concerned with rupture of the uterus due to such conditions as congenital anomalies or surgical trauma due to cesarean section or myomectomy. He deals, however, with ruptures due to the eroding action of villi in cases of placenta accreta or hydatid mole and also with ruptures which result from degeneration of the uterine muscle, phlebitasis and adenomyosis. He also takes up ruptures due to scars from previous myometrial injury which took place during normal or abnormal labor. In the latter group, the author includes scars which resulted from uterine apoplexy, curettage and manual removal of the placenta.

J. P. GREENHILL.

**Infantozzi, J., Ximeno, M. R., Crottogini, J. J., Granipietro, G., and de Santiago, A. P.: Pregnancy Near Term in a Uterine Horn and Tubal Gestation Near Term With Dead Fetus, Obst. y Ginec. Latino-Am. 1: 525-550, 1943.**

The authors report a case of near-term pregnancy in a rudimentary horn of the uterus and an advanced tubal gestation which reached the eighth month. In studying these cases the authors discovered a new radiologic sign which permits differentiation between an advanced tubal pregnancy and a gestation in a uterine horn. In cases of rudimentary horn pregnancy, the fetal membranes are thick, whereas in extrauterine pregnancies the membranes are thin. Likewise, hysterosalpingography offers a means of differentiating between these two types of pregnancy. In cases of rudimentary horn gestation, the customary triangular shape of the uterus is absent. The uterus is longer, thinner, and corresponds to a horn of a uterus duplex. In cases of tubal pregnancy, the uterus retains its triangular shape, although it is deformed by pressure of the adjacent fetal sac.

J. P. GREENHILL.

**Evans, E. Graham:** *Anemia in Pregnancy*, Illinois M. J. 84: 317, 1943.

The author gives a brief review of the literature and discusses the factors which contribute to anemia in pregnancy. He cites his observations of 117 cases and emphasizes the importance of early and repeated blood examination during pregnancy and the post-partum period.

He concludes that 87 per cent of his patients showed at some time a hemoglobin reading of less than 69 per cent (10 Gm.). The color index is usually low. He advocates the use of ferrous sulfate in 15 to 30 grain doses daily, until a normal level is attained.

FRED L. ADAIR.

**Sabathie, L. G.:** *Heart Disease and Pregnancy*, An. Catedra de clin. ginec. 2: 289-297, 1943.

There are four important causes of heart disease in pregnant women: rheumatic fever, hypertension, syphilis and arteriosclerosis. Rheumatic fever is the preponderant etiologic factor, and about 90 per cent of pregnant women have this type of cardiopathy. Among the rheumatic heart conditions, valvular lesions are most frequent (70 per cent), particularly mitral stenosis. It has been estimated that one in each 5,000 pregnancies is complicated by congenital heart disease. Generally speaking, these patients tolerate pregnancy very well, since most congenital conditions that permit survival to maturity do not compromise seriously the procreative capacity in a woman. Cardiovascular syphilis is extremely rare in pregnancy, but this would be expected, since only 25 per cent of such cases occur from 20 to 45 years, and of these 25 per cent, only 18 per cent occur in women. Bacterial endocarditis accounts for approximately 1 per cent of heart disease in pregnancy. It is frequently caused by abortion in cardiac patients.

In the diagnosis, evaluation of symptoms should be a matter for collaboration between the obstetrician and the cardiologist. A previous history of rheumatic fever is always significant. Dyspnea, tachycardia and edema are of relative value. Early diagnosis of cardiac insufficiency in pregnancy is extremely important in prognosis. Another factor of prognostic importance is the classification. Prognosis is favorable in Type I (American Heart Association), and IIa, reserved in type IIb and bad in type III. In addition, there are patients with questionable cardiac insufficiency, in whom the prognosis is good, and another group, constituting about a fourth of all patients with cardiac symptoms in pregnancy, who have functional disturbances. Serious mistakes may be made in regard to such patients, if they are not examined by an experienced cardiologist.

The uncertainty of the prognosis in many instances presents a serious ethical problem to the obstetrician, and the advice as to whether the pregnancy should be continued is always an individual problem, in which many factors, including social, economic, psychic and religious, must be considered and evaluated along with the physical state.

J. P. GREENHILL.

**Sodeman, William A., and King, Edward L.:** *The Heart in Pregnancy-Prognostic Aspects*, South. M. J. 37: 235, 1944.

Functional capacity of the heart rather than the anatomical defect is generally held to be of most importance in offering a prognosis to the pregnant patient with cardiac disease. The classification as outlined by the New York Heart Association has been widely accepted. The author believes that neither functional capacity nor anatomic defect alone is all important. In general, the functional capacity seems to be more important but the age of the patient, auricular fibrillation, cardiac enlargement, aortic stenosis, hypertension, active rheumatic fever, congenital anomalies,

previous failure, bacterial endocarditis, and general systemic disease may play a part in prognosis. Even when all factors are considered, the prediction of the course which the disease will take in pregnancy requires decisions in an illcharted field of medicine.

The author discusses each of the anatomical cardiac defects in relation to functional capacity and quotes his own plus the experience of others in their management. That a wide divergence of opinion exists among the best authorities in the management of the pregnant cardiac is apparent.

WILLIAM BICKERS.

### Puerperium

**Pereira, Joao Mario da S.: Incidence of Puerperal Infection Among 1,000 Deliveries,** An. brasil. de ginec. 7: 271-283, 1942.

The author reports the excellent results obtained after adoption of prophylactic methods at the Maternity Hospital "Arthur Bernardes" under the direction of Professor Clovis Correa da Costa. The factors operative in reducing the puerperal morbidity to a minimum are: frequent vaginal examinations are avoided; on admission, the patient undergoes a thorough vulvar "toilet"; the instruments are thoroughly sterilized; vaginal instillations of 2 per cent mercurochrome solution are made every four hours. In retention of cotyledons and large fragments of membranes, manual evacuation is done followed by washing of the uterine cavity with boiled water. Sulfonamide compounds and estrogens are used in cases of repeated handling and manipulations within the genital canal. In the author's opinion, this combined treatment constitutes the best means of combating puerperal endometritis. Sulfanilamide in powder form is applied to the uterine cavity in some cases of infection; in others Mouchotte's method of drainage is employed.

With these prophylactic measures, the puerperal morbidity among 1,000 deliveries was 4.2 per cent. There was no mortality.

J. P. GREENHILL.

**Duek, H.: Disinfection of the Vulva as Prophylaxis Against Puerperal Infection,** An. brasil de ginec. 8: 268-277, 1943.

The author employed a number of substances to disinfect the vulva during labor and checked his results by cultures. He found that the best substance for this purpose was 2 per cent mercurochrome. He claims that by the use of vulvar antisepsis, the incidence of puerperal sepsis was reduced in his Rio de Janeiro Clinic from 6.6 per cent to 1 per cent. He also discusses and compares the statistics concerning puerperal sepsis published from other countries.

J. P. GREENHILL.

### Venereal Diseases

**Ahumada, J. C., Gandolfo Herrera, R., and Sammartino, R.: Lymphogranulomatosis (Paltauf-Sternberg) of the Hypogastric Glands,** Bol. soc. de obst. y ginec. de Buenos Aires 22: 355-361, 1943.

The authors report a case in a woman, aged 34, whose symptoms of pain and tumor developed after an appendectomy performed when she was four months pregnant. Following the appendectomy an incomplete abortion occurred, necessitating two curettements. At operation, a tumor was found in the right parametrial region, filling and distending the broad ligament. The growth was hard, lobulated,

of firm consistency, the size of a small lemon, and intimately adherent to the posterior surface of the broad ligament and the pelvic wall. The ureter also was involved in the growth. The histologic picture conformed to that of lymphogranulomatosis of Sternberg in the third period of its development. It was impossible to follow the patient after she left the hospital.

The authors have found 12 cases of pelvic lymphogranulomatosis, including the one they report, with seven localized in the broad ligament. The first was reported by Luce in 1910, in a woman, aged 27, who presented a tumor similar to that described here; the patient died a month and a half after operation. Schlagenhauf (1911) reported the observation in a woman, aged 68, whose autopsy also showed tumor nodules in both parametria, with metastases in the bladder and ureter. Szemes, in 1928 reported a woman, aged 35, who at laparotomy was found to have intraligamentary tumor nodules on the right side. Autopsy two months later showed lymphogranulomatous formations disseminated in the right parametrium, uterus, both adnexa and bladder. The fourth case was reported by Levinski in 1930: a married woman, aged 37, was treated with deep radiotherapy. At autopsy, lymphogranulomatous formations were found in both parametria, uterus, adnexa, bladder and rectum. In the same year, Esau reported the case of a married woman, aged 52, showing at laparotomy an intraligamentary mass on the right side, which was removed easily. She died ten months later with no sign of local recurrence. The sixth case, reported by Burger, was in a woman, aged 42, with a right intraligamentary tumor which was removed without difficulty. The case reported here is the seventh of this type in the literature.

J. P. GREENHILL.

**Osmond, T. E.: The Modern Treatment of Gonorrhea in the Female, Brit. M. J. 4331: 51, 1944.**

The technique of examination and search for gonococci is described. Four grams of sulfathiazole are given every day for 5 days with a cure in the great majority of cases. If a second course of treatment is necessary, an interval of 5 days should elapse and the type of sulfa drug changed to the diazine or pyridine form. Symptomatic general treatment should also be given. Local treatment is of definite value in chronic cases, but in acute uncomplicated cases this is rarely indicated except for personal hygiene. Abscesses such as Bartholin's abscess should be drained. Various other complications are described and treatment mentioned.

To determine a cure one or two tests should be carried out at four-day intervals following completion of treatment, and then monthly examinations for at least three, and preferably six months before the patient is discharged as cured. These latter examinations should be carried out immediately after a menstrual period since it is at that time that gonococci, if present, are most easily detected. During pregnancy the same treatment should be carried out, care being exercised in the use of local therapy. Sulfa drugs are not contraindicated.

With regards to gonorrhreal vulvovaginitis in children, the author advises strict isolation. Chemotherapy is the treatment of choice. Local therapy and the use of hormones are mentioned.

WILLIAM BERMAN.

## Society Transactions

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### THE NEW YORK OBSTETRICAL SOCIETY

MEETING OF MAY 9, 1944

The following papers were presented:

**Carcinoma of the Ovary Treated Preoperatively With Deep X-ray Therapy—Report of 3 Cases.** Thomas J. Parks, M.D. (by invitation). (Will appear in a later issue.)

**Ovarian Fibroma and Thecoma in Relation to Ascites and Hydrothorax (Meigs' Syndrome). Analysis of 78 Cases Including Some Experimental Data.** I. C. Rubin, M.D., J. Novak, M.D., and J. J. Squire, M.D. (For original article, see page 601.)

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## Items

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### American Board of Obstetrics and Gynecology

#### Examinations

The next written examination and review of case histories (Part I) for all candidates will be held in various cities of the United States and Canada on Saturday, February 3, 1945, at 2:00 P.M. Candidates who successfully complete the Part I examination proceed automatically to the Part II examination held later in the year. All applications must be in the office of the Secretary by November 15, 1944.

All candidates are now required to be out of medical school not less than eight years, and in that time they must have completed an approved one-year internship and at least three years of approved special formal training, or its equivalent, in the seven years following the intern year. This Board's requirements for internships and special training are similar to those of the American Medical Association since the Board and the A. M. A. are at present cooperating in a survey of acceptable institutions.

A number of changes in Board regulations and requirements were put into effect at the Board's last annual meeting, held in June, 1944. These were designed to aid civilians as well as candidates in the Service. Among these is the waiver, temporarily of the A. M. A. requirement for men in the Army or Navy, especially for those who proceeded directly or almost so from hospital services into Army or Navy Service, upon a statement of intention to join promptly upon return to civilian practice. At this meeting the Board decided also to accept a period of nine months as an academic year in satisfying our requirement for certain years of training. This is only for the duration, and even men who are not eligible for Military Service but who are, nevertheless, in hospitals where the accelerated program is in effect, have been allowed to submit to us this short-time period of training in lieu of our previous requirements.

Beginning with the next written examination, which is scheduled to be held February 3, 1945, this Board will limit the written examination to a maximum period of three hours and in submitting case records at this time, all obstetrical reports which do not include measurements either by calipers and, as indicated, by acceptable x-ray pelvimetry, will be considered incomplete.

All candidates are required to take the Part I examination, which consists of a written examination and the submission of twenty-five (25) case history abstracts, and the Part II examination which consists of an oral-clinical and pathology examination. The Part I examination will be arranged so that the candidate may take it at or near his place of residence, while the Part II examination will be held late in May, 1945, or early June, 1945, in that city nearest to the largest group of candidates. Time and place of this latter will be announced later.

For further information and application blanks, address Dr. Paul Titus, Secretary, 1015 Highland Building, Pittsburgh (6), Pennsylvania.

SEPTEMBER 18, 1944.

### Directory of Medical Specialists

The biographic data of the first two editions of the Directory of Medical Specialists include only positions (internships, residencies, or assistantships) held during the course of training of men up to the time of their certification by the American Boards, and hospital and medical school staff positions then currently held.

It is desired to extend this data in the Third Edition to include all formal hospital and medical school appointments, with dates held, even though now resigned, as well as records of all Military Service including commissions and dates, either in World War I, peacetime in the Reserve Forces or in the present war.

Thus, a chronologically complete sketch of a Diplomate's entire career is to be included in this Third Edition of the Directory.

Membership or fellowship in national or sectional (not local) special societies, and national general societies with offices held, and dates, in any of these, should be reported.

Membership in recognized international medical societies may be included, but honorary or other membership in foreign medical societies should not be reported.

Reference to the Second Edition (1942) of the Directory may be made for lists of medical societies to be included in one's biographic sketch.

Families or secretaries of men absent in Military Service are asked to complete or correct previous listings, or new forms now being mailed to those eligible for inclusion in the Directory. Only those certified by an Official American Board can be included, and there is no charge for this listing.

The foregoing notice is published in response to many inquiries, to assist those certified by the American Board who are now engaged in correcting their previous listings, or preparing new sketches for the Third Edition of the Directory to be published early in 1945.

Communications should be addressed to the Directory of Medical Specialists, 919 North Michigan Avenue, Chicago 11, Illinois.